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editor's letter

The inspired decision by Dún Laoghaire-Rathdown County Council – one of the four Dublin area local authorities – to demand that all new buildings meet the passive house standard will deliver world class performance without increasing prices.

As I explained in an Irish Times article on the initiative, one of the reasons why passive house won't cause price increases is that anyone building a new home in Ireland has to achieve 60% energy reductions and install a renewable energy system to meet prima facie compliance with building regulations anyway. When the UK government provides clarity on Zero Carbon Homes, we'll be able to appraise whether the same argument applies on the other side of the Irish Sea too.

Dún Laoghaire-Rathdown's passive move is a progression from changes to Part L of the Building Regulations that this magazine's predecessor Construct Ireland helped to bring about from 2008 to 2011 – changes which in turn emerged from initiatives we worked on with local authorities such as Fingal, Wicklow, Dublin City and, yes, Dún Laoghaire-Rathdown in 2005 and 2006.

Ireland's Construction Industry Federation has immediately assumed a defensive posture. Hubert Fitzpatrick, director of the CIF and the linked Irish Homebuilders Association, which represents the developer builder – argued in the same Irish Times article that the draft policy would cause construction prices to increase, and that if the policy goes ahead "there will be very few houses built in Dún Laoghaire-Rathdown next year." The CIF raised similar objections as long ago as 1978, when it argued against proposals to make insulation mandatory for new homes on the spurious basis that it would cause house prices to rise.

The housebuilding industry appears to be similarly obstructive in the UK, if certain actions arising from the Housing Standards Review for England are anything to go by. The review led to communities secretary Eric Pickles removing the powers of English local authorities to set their own energy efficiency standards above building regulations. This thoroughly retrograde step jars utterly with the government's rhetoric on localism, and effectively forbids English local authorities from taking local action that could ultimately force standards to improve nationally. It's worth exploring, in the context of Britain's membership of the EU, whether this amendment – which effectively forbids English regions from protecting their constituents against rising energy prices, and prohibits key action on climate change – is legal.

Passive houses work. We have the benefit of 25 years of detailed monitoring to show that these buildings are genuinely energy efficient, healthy, comfortable and built to last. So the construction industry has nothing to fear from passive house and much to gain. Dún Laoghaire-Rathdown have shown great vision and leadership in backing an approach that delivers demonstrably high quality sustainable buildings. Of course many of the UK's local authorities are embracing passive house, with councils such as Exeter and Kirklees even pledging to require passive house for their own projects. If more follow suit, that gives significant scope to add to what has already been considerable growth in passive house across the UK.

But if the industry stops blindly objecting, and instead engages and starts working out how to deliver this cost-effective quality standard, it won't look back.

Regards,
the editor

International PASSIVE HOUSE Association iPHA

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Jeff Colley: winner green leader award -Green Awards 2010

Construct Ireland: winner green communications award -Green Awards 2010

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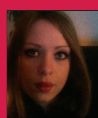

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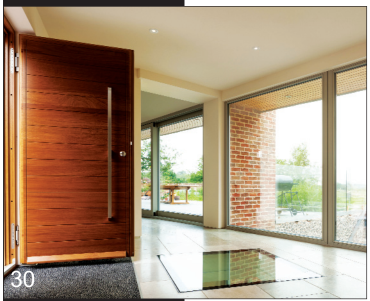
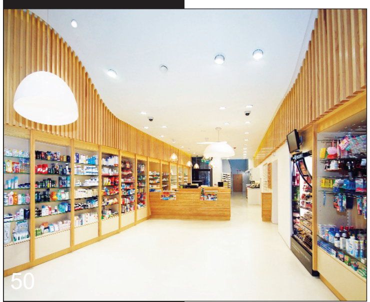
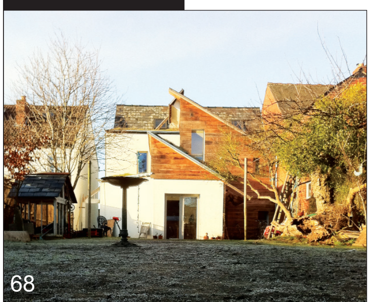






News

Components centre stage at 2015 International Passive House Conference

The passive house standard enables every building owner to benefit from the energy revolution, with certified passive house components ensuring cost-effectiveness. This basic concept will be the focus of the 2015 International Passive House Conference, held from 17 to 18 April 2015 in Leipzig.

Over a hundred speakers from all over the world will present exemplary projects and solutions for building and ventilation systems and windows within the context of new builds and retrofits. An exhibition will provide specific examples of products currently available on the market. The conference programme is now online at www.passivehouseconference.org

"Passive house components allow building owners to save hard cash", says Dr. Wolfgang Feist, director of the Passive House Institute. "The certificate provides planners and architects with a high reliability that the calculated energy efficiency of a building will be achieved in practice." Besides the economic viability of the passive house standard, the focal points of the event will include challenges of specific building uses and of different climatic circumstances. The conference takes place under the auspices of Sigmar Gabriel, German Federal Minister for Economic Affairs and Energy.

Over a third of total energy consumption in industrialised countries is attributable to buildings and to heating in particular. Up to 90 percent of this energy can be saved in a passive house, meaning the remaining energy demand can easily be covered by renewables. The passive house standard is therefore an ideal basis for the nearly zero-energy building, requested in the EU Energy Performance of Buildings Directive, which comes into effect for all new buildings in 2021, and for all new public buildings in 2019.

Since 1997, the International Passive House Conference has been held annually by the Passive House Institute in different locations.

The city of Leipzig, the Saxony Chamber of Architects and the University of Innsbruck are co-organisers of the 2015 conference. Some of the lectures are embedded into the EU-funded EuroPHit (step-by-step retrofits) and PassREg (Passive House regions with renewable energies) projects. In addition to the exhibition, the conference will be complemented by a number of workshops and excursions.

(above) Congress Centre Leipzig, the venue for the 2015 International Passive House Conference

Passivhaus Trust to present series of Ecobuild seminars

The Passivhaus Tust has organised a series of passive house themed talks as part of the 'Designing Better Buildings' seminars at this year's Ecobuild.

According to the trust, this series of events will look at "how to realise good quality, low energy buildings that promote the well-being of occupiers."

These seminars will examine both fabric-first design and building services, and will look at how to balance the requirements of building regulations and different rating systems with cost-effective, good design.

Topics of these seminars will include 'passive house: a model for designing or local climate differences as well as for anticipated climate change?', 'learning from refurbishment successes in Europe', 'can passive house lead to a zero-carbon future for the UK?', 'passive house: delivering small, medium and large-scale projects', and 'performance in practice with a fabric first approach'.

Speakers will include a range of national and international experts in passive house and low energy building. The Passivhaus Trust will also launch its 2015 awards at Ecobuild.

The trust will also be promoting its new publication, 'How to Build a Passivhaus: Rules of Thumb'. For detailed information on each event and the speakers, visit http://tinyurl.com/l6u25mx This year's Ecobuild show takes place from 3-5 March at the Excel convention centre in London.

News

The Green Register to host Wufi courses in London this March

The Green Register is again offering an opportunity for construction professionals to attend two days of specialist Wufi Pro training in London on March 26 and 27.

"Following the great success of our collaboration with the leading UK Wufi experts in 2013 and 2014, we are very pleased to be re-running the world class Wufi software course for construction professionals in London," said Lucy Pedler, director of The Green Register.

The two-day course, run by expert trainers Joseph Little of Building Life Consultancy and Christian Bludau of the Fraunhofer Institute for Building Physics, provides a practical, hands-on introduction to Wufi Pro hygrothermal numerical simulation. It is the world's leading simulation software for understanding the risk of interstitial condensation, mould, rot and freeze-thaw in buildings.

"Building Life Consultancy are always delighted to partner with The Green Register to bring high quality risk evaluation software to London," commented trainer Joseph Little.

The workshop is open to all building professionals, such as architects, engineers, surveyors, insulation suppliers, system manufacturers, builders and anyone with a focus on fabric performance. No previous experience with the Wufi Pro software is required.

(above) Wufi expert Joseph Little of Building Life Consultancy will be delivering the Green Register's training course with Christian Bludau of the Fraunhofer Institute for Building Physics

Course fees include the two-day course tuition, course materials, light refreshments and lunch on both days, and the full version of the Wufi Pro software with a six-week temporary licence, as well as access to support on the online Wufi forum for that period.

In 2013 and 2014, the two-day workshops all sold out. Places on the course are limited so interested delegates are advised to book early. The cost is £650 for Green Register members and £700 for non-members. To book online visit www.greenregister.org.uk/events

Irish local authority makes passive house mandatory

Dublin-based local authority Dún Laoghaire-Rathdown County Council has voted to make the passive house standard mandatory for all new buildings in the area as part of its latest development plan.

At a meeting of the local authority on Wednesday, 11 February, councillors voted by 23 votes to 14 to add wording to the 2016-2022 local development plan stating it is, "Council policy that all development in new buildings should be built to the Passive House standard."

The motion also stated that nearly zero energy buildings (NZEBs) or other lower energy standards may be considered as appropriate alternatives.

The Passive House Association of Ireland together with Passive House Plus, which has its own office based in the area, organised a trip for councillors to Niall and Monica Walsh's passive house in Mount Merrion in advance of the vote, during which presentations on the passive house concept and its benefits were made. The 256 sq m house, which is profiled on page 62 of this issue, has cost less than €200 per year for combined space heating and hot water since the family of four moved in.

The draft development plan will now enter a public consultation period that will begin on 2 March and last for ten weeks.

Dún Laoghaire-Rathdown County Council has a history of demanding higher energy efficiency standards than national regulations. It was one of the first local authorities, back in 2007, to demand that buildings be constructed to more stringent energy efficiency standards than national regulations, passing 40% energy and carbon reduction targets, along with mandatory renewable energy systems.

Local authorities in Ireland can set energy efficiency standards above levels in building regulations as a planning condition, something which is not possible in England after the Conservative-Liberal Democrat coalition removed a clause in the Planning Act that permitted councils to set their own energy efficiency standards above those contained in building regulations.

The Construction Industry Federation has come out in opposition to Dún Laoghaire-Rathdown plan, claiming it would lead to an increase in the cost of new build in the area. If the passive house clause makes it into the final version of the development plan, Dún Laoghaire-Rathdown County Council would become the first local authority in the world outside of continental Europe to make the passive house standard mandatory.

Meanwhile, Kirklees Council in West Yorkshire is now considering making the passive house standard mandatory on all council-owned land, including land that's sold for development.

To read more on the rationale for making passive house mandatory, read a piece by the editor on page 78.

News

Warmcel used to insulate passive & ecological UEA Enterprise Centre

PYC Insulation has completed its part in delivering a project that is set to be one of the UK's most high profile sustainable buildings. The Enterprise Center at the University of East Anglia is one of the company's largest installations to date.

Once open, the building's function will be to inspire businesses, students and entrepreneurs to work together to develop new ideas and business-start ups. This passive house and Breeam Outstanding building was designed by Architype, and delivered by Morgan Sindall and Cygnum Timber Frame.

The specification required the installation of over 63 tonnes of Warmcel cellulose insulation into the timber frame structure, which was constructed using locally sourced Corsican pine. Over 6,800 airtight Pro Clima patches were used to seal the injection holes, helping the building to achieve passive house airtightness levels.

The building was constructed from at least 80% natural materials, including the timber frame, thatch cladding, and Warmcel's recycled newspaper cellulose insulation.

Jasper Meade from PYC Insulation said: "This building will benefit from Warmcel's thermal performance, improved airtightness and decrement delay properties as well as verified sustainable environmental advantages which lock carbon in, and dramatically reduce the building's heating requirements. It is good to see more of these buildings at this scale — and that quality, high performance, sustainable buildings are at last becoming mainstream."

The building is set to be completed in March 2015, and is set to be profiled in detail in Passive House Plus.

(above) The UEA Enterprise Centre is being built to passive house thermal performance levels using highly ecological materials

Viessmann launch home fuel cell system

Viessmann has announced the launch of new electricity-generating domestic fuel cell technology that, the company says, could save homeowners up to £400 a year on electricity bills. The system has been installed for the first time in a four-bedroom house in Wolverhampton, where it is expect to cut 36% off the homeowner's total energy spend and reduce CO_2 emissions by half.

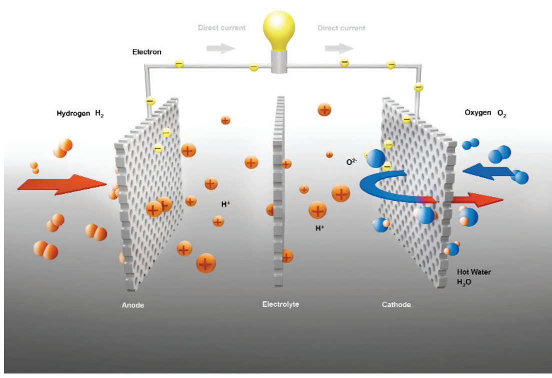
The Viessmann Vitovalor 300-P system is designed to be easy to install in existing properties with a gas supply – as an alternative to a regular boiler replacement for example – as well as in new builds. The system converts natural gas into hydrogen to generate both heat and power.

Comprising a Panasonic fuel cell unit, a Viessmann peak load boiler (for use on only the coldest days of the year) and hot water tank, the system requires the same connections as a gas boiler. The system is MCS-approved, meaning it has been rigorously tested to comply with industry standards and qualifies for the feed-in-tariff.

The energy created by the Vitovalor 300-P – approximately 4,500 kWh per year – is equivalent to that generated by thirty square metres of solar PV panels, according to Viessmann. Homeowners can track the savings they are making, in real time, via a Smartphone app.

Darren McMahon, marketing director with Viessman, said: "To continue to reduce CO_2 emissions and make ourselves more energy efficient, we need to develop solutions for gas. Generating our own electricity at home is about twice as efficient as relying on centralised power stations. The Vitovalor 300-P is a technology available today, that reduces CO_2 by 50 per cent. This first installation into a domestic dwelling in the UK is a significant moment."

According to Viessmann, the Vitovalor 300-P is the first mass produced, commercially available domestic fuel cell heating appliance on sale in Europe. The system features a polymer electrolyte fuel cell (PEFC)-based micro combined heat and power (mCHP) system. Viessmann jointly developed the Vitovalor 300-P with Panasonic.



(above) The Viessmann Vitovalor 300-P converts natural gas into hydrogen, a process that generates both heat and power

News

Norrsken launch passive house certified Viking window

Low energy window supplier Norrsken has announced the launch of a new passive house certified, outward-opening window from Estonian manufacturer Viking to the UK. The Viking SW14 aluminium-clad timber window is certified by the institute to have an overall U-value of 0.80 but can go as low as 0.63 depending on size. It has a 50mm profile of triple glazing with two low-e coatings, warm-edge Swisspacers, and argon fill.

The product represents a major upgrade on Viking's existing triple-glazed SW11 window, which has an overall U-value of 0.9W. The frame of the SW14 has also been modified to allow for more overlap for airtightness membranes. "They've beefed everything up to comply with passive house," Alex Alsop of Norrsken told Passive House Plus. "It looks great too, it's a beautifully finished window."

The SW14 window combines the traditional outward-opening style of British windows with ultra low energy performance. Inward-opening windows are more common on the continent where external shading is prevalent, while outward-opening windows are more typical in the UK, where internal curtains are more common.

Alsop added that it is generally more difficult to make outward-opening windows as energy efficient as inward-opening units, because the outward-opening sash is quite thin and flush with the outer edge of the frame. With inward-opening units, the sash tends to be as deep as the frame. However the Viking SW14 features a dual gasket system that allows for a much deeper glazing profile, enabling it to achieve passive house performance.

Norrsken also supply a range of high performance windows and doors under its own brand name, including its Norrsken Passiv and Passiv + range.

(above) The Passive House Institute certified Viking SW14 aluminium-clad timber window

Saint-Gobain to launch Multi-Comfort concept at Ecobuild

Saint-Gobain will launch its 'Multi-Comfort' concept at this year's Ecobuild show, as well as celebrating its 350th anniversary.

'Multi-Comfort' buildings are designed to not only save energy but to improve occupant health, wellbeing and productivity, according to the company.

Visitors will be able to experience the concept first hand at Saint-Gobain's Ecobuild stand, which will feature 'experience pods' that allow visitors to feel the individual elements such as indoor air quality as well as thermal, audio and visual comfort.

A dedicated website and brochures will accompany the launch at the show, while experts will be on hand to help visitors put theory into practice.

Richard Halderthay, director of communication for Saint-Gobain UK, Ireland & South Africa, said: "Saint-Gobain UK & Ireland is pleased to be returning to Ecobuild in our 350th anniversary year.

"As we celebrate our milestone birthday, we are also looking at 350 reasons to believe in the future. The launch of 'Multi-Comfort' supports our belief that sustainable habitat is within our reach. By providing sustainable products and solutions, this vision can be made a reality.

"Ecobuild is an important event in our calendar, as it's a place for the industry to come together to discuss key issues and showcase innovation. We have a number of exciting events and surprises planned for Ecobuild, and we look forward to welcoming visitors to our stand and introducing them to Saint-Gobain's vision for the future."

You can visit Saint-Gobain at Ecobuild, held at ExCel London from 3–5 March, on Stand N6050/N6060 and in the main boulevard. For more information, visit www.saint-gobain.co.uk

News

Smet launches EasylationWall external insulation system

Smet Building Products has launched Easylation-Wall, an easy-to-use external wall insulation technology based on brick slips and utilising natural stone or ceramics. The system incorporates extruded polystyrene (XPS) insulation.

According to Smet, the main benefits of Easylation-Wall include short construction time and assembly, high insulation values, low cost due to the light construction method, and a dry construction method that is not weather dependent. The system is also 99% recyclable and free of thermal bridges, and is moisture-regulating. It comes with a ten year product guarantee.

Smet director Joris Smet said EasylationWall can be installed in new-builds and renovation projects and is also very suited to off-site construction systems, such as timber frame, steel-frame and prefab concrete construction.

Planning conditions in some areas may dictate that the existing brick façade may have to be entirely replaced like-for-like in retrofit projects, keeping the new façade consistent with the old. “EasylationWall EWI system complete with a brick slip finish, results in both improved thermal performance of the building and a façade finish in-keeping with the area,” said Joris Smet.

The brick slips are created by sawing a shell of approximately 22 mm thickness off a complete whole brick. This is possible with almost any type of brick – clay fired brick, concrete brick and calcium silicate brick. In addition to flat slips, corner slips (L-shaped) and half bricks can also be created. Any type of stone or ceramic may be utilised to create the brick slip finish, including natural stone, glass and ceramic.

The system can incorporate up to 30cm of insulation and deliver U-values as low as 0.11. “The high density XPS insulation boards have a high thermal resistance and excellent impact resistance for durability,” said Smet, adding that due to the sealed cell structure, the system is damp proof.

Smet has partnered with leading supplier, Brick and Stone, to distribute EasylationWall. “We are also delivering comprehensive training and demonstrations to Brick and Stone, ensuring all agents are proficient in the superior benefits of EasylationWall external wall insulation system,” said Smet.

(above) The EasylationWall brick slip system

Munster Joinery opens Belfast showroom

Munster Joinery has announced the opening of a new showroom in Belfast with over 120 products on display. The showroom offers architects, builders and homeowners in Northern Ireland the opportunity to see Munster products locally, including the company’s range of passive house certified windows.

“The purchase of windows and doors represents a significant part of the spend on any project. There are a wide range of factors to be considered such as thermal performance, acoustic performance, solar gain, luminous factors and weather-tightness as well as aesthetics. Be the project new build, extension or refurbishment, the customer is inundated with masses of literature for various products making it difficult to differentiate. The hands-on clarity offered by the showroom situation is the ideal way to make an informed selection,” said Marlene O’Mahony, quality manager at Munster Joinery.

Window technology has become increasingly more complex in recent years. Many of the Munster products on display have been certified as being suitable components for passive housing and low energy buildings by the Passive House Institute in Germany. O'Mahony says the showroom will be an easy way for the customer to get a feel for some of the technology involved – double, triple and even quadruple-glazing, low emissivity glass coatings, warm edge spacer bars, and low conductivity gas fills such as argon and krypton.”

“The diversity of ranges, materials, colours, operating systems, glazing types and levels of performance on offer make it much simpler to select the correct windows and doors for any project.”

Munster Joinery is a family owned company with manufacturing locations in Ireland and the UK, and is now one of the largest window and door manufacturers in Europe. “The company has responded to the energy challenge facing businesses globally today by investing heavily both in efficient product design and in green and sustainable operations,” O'Mahony said.

The company's 900,000 square foot production facility in Ballydesmond, Co Cork is largely powered by two on-site wind turbines with an output of 4.2MW. Timber off-cuts and sawdust from the process are used to fuel a combined heat and power plant delivering 12MW thermal and 2.8MW of electrical energy.

News

DVS gets first UK environmental product declarations for rooflights

DVS (Daylight & Ventilation Solutions) has become the first UK rooflight company to provide environmental product declarations (EPDs) for all its rooflight domes, continuous rooflights and large-area glazed roof constructions. DVS is the sole UK supplier of the German-made Lamilux range of daylighting products, including five passive house certified systems.

EPDs provide comprehensive information on the environmental impacts of products, allowing their contribution to the sustainability performance of a building to be assessed.

EPDs are issued subject to the specifications in the BS EN 15804 standard and allow for valid conclusions on the environmental impact of a product from cradle to grave, from production and raw materials, through the consumption of resources during the product's service life, to the product's removal and disposal.

EPDs are recognised by numerous international building certification systems, such as DGNB, Breeam and Leed. EPD certification of the Lamilux products was carried out in Germany, by ift Rosenheim, a leading testing and certification specialist for construction products.

Sustainability consultant Martin Blumberg said: "Whether or not a building is sustainable, is largely determined by the materials used. Lamilux has clearly demonstrated, in attaining these EPDs, that its products play a positive role in the holistic sustainability consideration of buildings."

Lamilux products feature a high proportion of recyclable components and high levels of thermal insulation, as well being water-tight and low maintenance throughout their lifecycle.

Martin Blumberg continued: "All of these aspects have now been exhaustively examined and quantified in the EPDs." The individual results for the Lamilux products can be retrieved directly from a database (the Ökobau.dat Information portal for sustainable construction).

(above) DVS (Daylight & Ventilation Solutions Ltd) provides EPDs for a wide range of rooflighting products, from rooflight domes to large-area glazed roof constructions

Psi-Therm thermal bridge software launches in UK

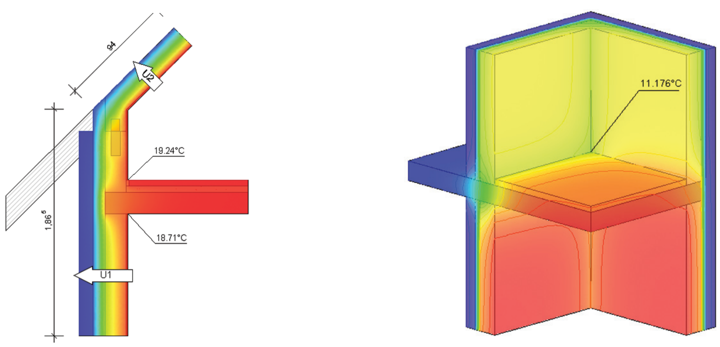
The thermal bridge assessment software Psi-Therm has officially launched in the UK, along with a new website, www.psitherm.uk. The company is also offering a 10% discount to Passive House Plus readers until the end of March if they mention the magazine when ordering.

Psi-Therm is an ISO-validated thermal bridge assessment software that can be used to assess, calculate and optimise designs to minimise thermal bridges and eliminate surface condensation.

Psi-Therm also offers in-house and online training courses in the use of the software. The new website also features a forum for users to discuss thermal bridging and access a community of Psi-Therm users for any questions they have about the software.

Andy Lundberg, building physics expert and certified passive house designer with Psi-Therm, told Passive House Plus that there is growing demand for thermal bridging assessment software in the UK, as architects and designers look to achieve better SAP ratings rather than use punitive default thermal bridging factors.

Psi-Therm is also accredited to ISO077-2 for window frame U-value analysis, and the company offers a window frame U-value calculation service.



(above) Psi-Therm enables detailed 2D and 3D thermal bridging analysis

News

Pro Clima launches Contega Solido airtight & windtight tapes

Pro Clima has launched its new range of Contega Solido airtightness and wind-tightness plaster sealing tapes, for a range of internal and external applications. The range is available in Ireland and the UK from Ecological Building Systems.

It is widely accepted that to attain optimum levels of airtightness in masonry construction, the internal block must be plastered continuously with a suitable plaster layer. In order to limit air leakage, it is critical that the plaster on the inside of external walls is continuous and bonds to adjacent building elements continuously without gaps or cracks occurring. Windows and door junctions are often highlighted as one of the primary areas where air leakage occurs in buildings, particularly in masonry constructions where the internal plaster layer forms the airtightness layer and the external plaster layer forms the wind-tightness layer.

Contega Solido SL is an internal airtightness and vapour control sealing tape which may be used to seal windows, doors or even beams penetrating the external block walls, directly to masonry or timber surfaces. Following this the tape may be plastered directly on the specialist fleece layer. Contega Solido SL tape may also be used to seal vapour control layers (such as Intello Plus) to block walls at wall plate level.

Contega Solido EXO is an external wind-tightness and diffusion open sealing tape which may be used to seal windows and doors to external block walls or timber surfaces. It can also be plastered directly on the specialist fleece layer. Contega Solido EXO wind-tightness tape may be used externally to seal windows or doors to block surfaces, for plastering later.

Both Contega Solido SL & EXO feature two release papers, allowing installers to "activate" individual parts of the glue, for ease of installation at critical junctions. The Contega Solido range also features Pro Clima's patented solid acrylic glue, guaranteeing optimum bonding to surfaces.

For more information or samples of the Pro Clima range of Solido tapes or any other airtightness & wind-tightness enquiries, contact Ecological Building Systems. More information is available at www.ecologicalbuildingsystems.com

(above) Contega Solido SL tape sealing a Pro Clima Intello membrane to poroton construction

Ancon launches 'Acoustic' range at Ecobuild 2015

Ancon, specialist in the design and manufacture of high integrity steel structural fixings, will introduce its new 'Acoustic' range of cavity wall ties and shear load dowels at the UK's leading sustainable construction event, Ecobuild 2015. The company, which also offers ranges of low thermal conductivity wall ties & balcony connectors, has now turned its attention to improving the sound resilience of buildings.

Ancon acoustic wall ties connect the leaves of a cavity wall and feature a pre-compressed acoustic isolation element to minimise the transfer of airborne noise. Typical applications for these high performance products are recording studios and cinemas, however Ancon say they are equally suitable for any new build residential development, as they comply with Approved Document E of the English building regulations as a type A tie for separating walls. Available in incremental lengths of 25mm, the new Ancon ACOU range suits a cavity range of 50mm to 175mm.

The new Ancon acoustic dowel is designed to transfer shear load and allow essential movement at joints in concrete frames, while also reducing impact sound through a building by isolating adjacent concrete elements. The stainless steel Ancon dowel locates in a sound damping sleeve that de-couples components such as stairs from the main structural frame. Typical applications include multi-occupancy buildings, like hotels and apartments, where unwanted noise can adversely affect a person's concentration, relaxation and sleep.

Also on show will be Ancon's full range of low thermal conductivity, corrosion-resistant building products including basalt fibre wall ties for masonry and timber frame buildings, stainless steel brick support systems and insulated balcony connectors. You can visit Ancon on stand N3090 at EcoBuild to see examples of all new products and to speak to a technical advisor.

(left) The new Ancon Acoustic range

News

Variotherm technology heats & cools energy-plus Stuttgart research house

Photo: Zooey Braun

Technology from Austrian heating and cooling specialist Variotherm has been installed on a pioneering new energy-positive house in Stuttgart, Germany.

The Bruckmannweg 10 (B10) research house produces almost twice as much energy as it consumes, and is located in the heart of Stuttgart's famous Weissenhof Estate, which was built in the 1920s to showcase the international style of modern architecture, and features two Le Corbusier houses.

The B10 dwelling is of timber frame construction infilled with vacuum insulation panels, specified because the tight nature of the site meant the walls had to be thin. The white-and-glass modernist style house was completed last year, and boasts a solar photovoltaic roof array that generates about 8,300 kilowatt hours per year and charges two electric cars.

A water-to-water heat pump is the main source of heating, drawing on a water tank buried in the ground nearby. Heat is delivered throughout the house via Variotherm wall and ceiling based heating and cooling systems. Solar thermal collectors feature on the roof too.

The house's intelligent energy management system can be controlled by smartphone or tablet, while insulating panels roll down over the glazed facade at night to keep heat in.

The car is kept within the thermal envelope of the house, to test whether this will reduce the vehicle's need for heating and thus helps to maximise battery life. Excess electricity is exported to the house next door.

During the first phase of the project, the building will be open for members of the public to visit and learn about the design. During the second phase, two students will live in the house free of charge. Data on the energy generated and consumed by the building — plus reams of other information — is being collected and analysed by a team from the University of Stuttgart.

The house is also designed to be completely recycled at the end of its life. "It is about leaving the generations that come after us a built environment without gigantic mountains of rubbish or huge energy consumption," said its architect Werner Sobek.

Variotherm products are supplied in Ireland and the UK by Blackrock-based HWI Sustainable Buildings.

Lacuna launches low energy bi-folding doors

Danish company Lacuna has launched its range of low energy bi-folding doors in the UK and Ireland. The Lacuna doors, which have been tested at the IFT Rosenheim testing centre in Germany, and certified by the approved testing centre at Danish Technological Institute, have overall U-values down as low as 0.7.

Company founder Henrik Brunsø said: "Having spent a good part of my childhood in Greenland, where the impact of wind, water and salt is high almost all year around, it was important to me that we produced a door which could withstand such harsh conditions. We now have doors successfully installed in Greenland, Norway and on the Shetland Islands."

The doors are made from heat-treated beech, and during the heating process (24 hours in a 198C hot oven) the properties of the wood structure changes permanently. In addition to the increase in natural durability, the heat treatment also makes the timber very stable and durable, and accordingly it does not absorb moisture and expand in humid weather.

Another advantageous effect of the heat treatment is that it fills the timber structure with air. Brunsø added: "Through a microscope one is able to see that it consists of many small air pockets neatly packed together; and it is these that give the wood the excellent insulation properties and thereby the low U-value."

Air permeability of the Lacuna bi-folding doors has been tested to EN 12207 class four at +/- 600 Pa, and water tightness to EN 12208 Class E1200. All ironmongery is made of the highest marine-grade acid-proof stainless steel.

(right) Lacuna low energy bi-folding doors, available in the UK and Ireland

News

Econekt on site with low energy ICF social housing

Scottish insulated concrete formwork (ICF) supplier Econekt is currently on site with two low energy projects that the company believes may be the first ICF social housing projects in Scotland.

The first is a development of 15 houses in the town of Greenock, west of Glasgow, for Oaktree Housing Association. Econekt supplied ICF walls for the development that deliver U-values of 0.15 with 150mm of external insulation as part of the 350mm single skin wall construction. Econekt also supplied Spantherm pre-insulated, pre-cast ground floor slabs for the project.

"The way we have our walling element detailed means it's designed to be thermal bridge free at the junction between walls and the slab," Econekt's Frazer McLachlan told Passive House Plus.

McLachlan told Passive House Plus that, even though airtightness detailing wasn't a requirement of the project, he still expects it to get in the region of 1 to 1.5 air changes per hour because of the inherently airtight nature of ICF. "It's what's expected as a standard when working with the Econekt system," he said.

"ICF allows for quality control very easily, because it's very difficult to make a mistake with it. Its simplistic nature ensures that airtightness and insulation is built into the fabric as standard."

Econekt is also currently working on a second project, a block of eight apartments in Argyll, which is being built to the same specification.

(above) Econekt are currently on site delivering ICF homes for Oaktree Housing Association in Glasgow

Irish company launches thermally broken window sills

A new Irish company is manufacturing window sills in County Cork designed to eliminate thermal bridging at this critical building junction. Founded by Patrick Beausang, Passive Sills produces window sills and over sills from a high density expanded polystyrene core that is coated with a polymer resin.

"Previously with concrete window sills, the sill was a detail you tried to insulate. Whereas now with this product, the sill is the insulation," Beausang said.

The resin, which the company developed itself, is designed to give the sills a traditional appearance. Beausang said: "In Ireland, we like our traditional stone and concrete sills. We don't like putting an aluminium sill on a Georgian building. What we have done is develop something with all thermal efficiency you require, but that looks like a stone or concrete sill."

Passive Sills has its own factory in Middleton, Co Cork, and is supported by both the Enterprise Ireland New Frontiers entrepreneur development programme at the Rubicon Centre in CIT, and the South Cork Local Enterprise Office.

"We've been manufacturing for about 18 months. I started off making them in my garage, and we now have a 4,000 square foot factory."

The company is currently going for BBA certification, and Beausang said that the product has been used on about 50 projects to date. He said the sills are capable of supporting a quarter of a tonne of weight on a one metre section.

Beausang added that because the polystyrene core is high density and inherently resistant to moisture and condensation, it doesn't require a damp proof course and doesn't experience condensation.

Passive Sills are lightweight, designed for easy installation and painting, and suitable for all types of construction. They can be used as over sills which cover existing window sills, or for new window sill installations.

(below) Passive Sills feature a high density expanded polystyrene core but offer a traditional sill look

News

Zehnder partners with Passive House Academy to offer certified training

Zehnder Group UK has formed a partnership with the Passive House Academy to offer a certified passive house tradesperson course at a new training facility at the National Construction College in Glasgow. The course has been designed to provide participants with the opportunity to learn the practical skills required to achieve the passive house standard.

Zehnder, one of Europe's leading suppliers of energy efficient indoor climate solutions, offers a complete range of ComfoAir domestic heat recovery ventilation units that have all been certified by the Passive House Institute.

The Passive House Academy has been a leader in passive house training, development, certification and consultancy for over a decade.

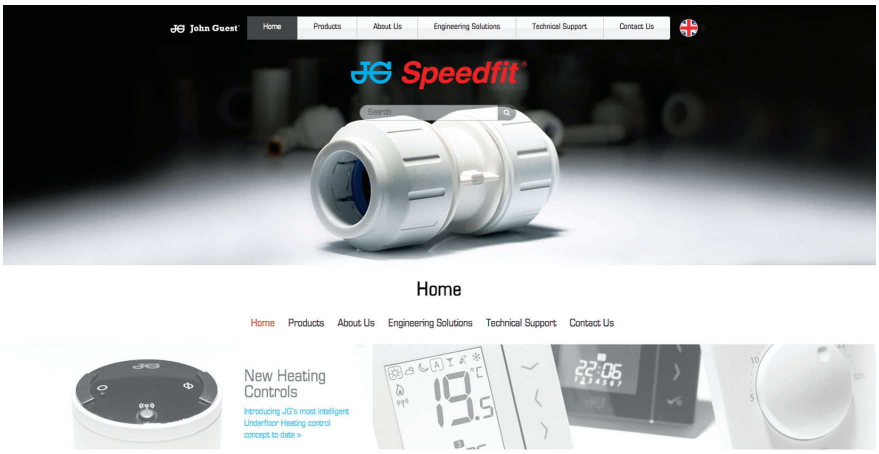
Trainees at the new Glasgow facility will have the opportunity to familiarise themselves with Zehnder's MVHR units, as well as their associated components, as part of their course.

"Our New York Academy has collaborated with Zehnder America successfully for some time, so when it came to specifying a ventilation system, including professional backup, for our Glasgow facility, Zehnder UK was a natural choice," said Art McCormack, director at the Passive House Academy. "Moreover, Zehnder UK has been instrumental in the development of our Glasgow facility, right from the planning stages through to completion."

For more information on the certified passive house tradesperson course at the Passive House Academy visit http://tinyurl.com/q5qvjoj

(above) Trainees at the National Construction College in Glasgow will have the chance to familiarise themselves with Zehnder's MVHR range, such as the ComfoAir 180

New website for JG Speedfit



Underfloor heating specialists JG Speedfit have announced the launch of their new website, which was designed to give a particularly visual focus on the functionalities of the brand's product ranges.

The new speedfit.co.uk website is now easily accessible from a mobile phone or a tablet and is full of installation videos, showing how to best use JG Speedfit's products.

The website reflects the company's philosophy of making the life of the installer a lot easier as speedfit.co.uk now has more examples of best installation practices, technical advice and product specification.

This is in line with the launch of the company's latest product ranges, including JG Aura – the new heating controls concept, which allows for a more flexible and efficient remote regulation of any underfloor and central heating system.

Green Building Store to exhibit in Birmingham

Green Building Store will be exhibiting at the Homebuilding & Renovating Show that runs from Thursday 26 to Sunday 29 March in the NEC, Birmingham.

The company will be showing its range of high performance timber windows, including its Econtract, Econtract Ultra, sliding sash and Progression windows. It will also be exhibiting the Paul Novus 300 & Focus 200 mechanical heat recovery ventilation systems.

In addition, Green Building Store director Chris Herring will be giving a masterclass (in masterclass theatre one) on Saturday 28 March at 11am, entitled: 'An introduction to passive house - a fabric first approach to energy efficiency'.

You can register for free tickets to the show by visiting http://tinyurl.com/qagq2pd

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Other (please state): ______________________

Floor area (approx. ft² or m²): ______________________

Budget (approximate): ______________________

Stage (tick box)

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Commencement notice ☐

Project imperatives (tick box)

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Low environmental impact ☐

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Why poorly conceived energy efficiency efforts may cause asthma

*A new UK study has unearthed a worrying correlation between energy efficiency and asthma. Study co-author **Richard Sharpe** sheds light on work that demonstrates the need for energy efficiency approaches that enhance rather than threaten occupant health.*

Increasing household energy efficiency through retrofitting existing properties is now one of the UK's and Ireland's strategies to meet energy and climate change targets, as well as helping to protect against cold-related illnesses. Greater insulation and sealing properties to prevent heat loss can help those in fuel poverty, which is a public health problem affecting around 2.4 million homes in the UK.

Yet throughout this process, the impacts on the indoor environment have often been overlooked. As we begin to understand the importance of internal housing conditions to good health and wellbeing, we're shedding light on how some building designs are compounding indoor air quality problems.

It is generally accepted that living in homes with reduced ventilation rates can lead to problems with condensation and mould growth. It is also known that the state of our indoor environments is influenced by a number of factors. Heating, insulation, ventilation and people's behaviours, along with the type, orientation and geographic location of a property, all work to affect the air quality in our homes.

Over recent years we've witnessed a rise in allergic diseases that can't be explained by factors such as genetic changes alone. The United Kingdom has one of the highest occurrences of asthma in the world, with the disease presenting substantial economic and societal pressures. This has led to an increased focus on indoor air quality to explain this rise – and a robust body of evidence now suggests that rates of allergic and respiratory disease are linked to poor indoor housing conditions.

Yet no study has been able to assess how increasing household energy efficiency may impact the health and wellbeing of people living in homes with inadequate ventilation and mould growth.

Based at the University of Exeter Medical School's European Centre for Environment & Human Health, we recently published findings from a systematic review, which showed damp and specific types of mould can pose a significant health risk to people with asthma. We then conducted a study[1] based on 700 social housing properties in Cornwall, to examine how poor air quality and dampness can affect the health of people living in energy efficient homes.

We found that greater household energy efficiency represented a higher risk of asthma, but at the same time lowered problems with indoor mould contamination.

There are a number of potential explanations for these findings, but we believe that a failure to heat and ventilate the home is likely to lead to exposure to dampness-related pollutants. The study pointed to other possible factors which can affect health in homes with high humidity, such as different types of moulds, house dust mites and bacteria, as well as other biological, chemical and physical pollutants not assessed in this study. While greater insulation in energy efficient homes may reduce the risk of condensation, this may be impacted by fuel poverty where people make choices about the way they heat and ventilate the home to reduce the cost of fuel bills.

This study, published in the journal Environment International in 2015, raises questions about the way energy efficiency improvements are made and the importance of ventilation. It represents the first time we have been able to combine detailed asset management data with information about occupant behaviour and health, to assess the factors likely to contribute to asthma, but there are many questions yet to address.

It is vital that we continually improve the energy efficiency of homes to reduce the carbon footprint of the domestic sector and make homes more affordable to heat, but we need to address the effectiveness of current ventilation methods and the role of occupant behaviours. For example future work needs to consider how ventilation systems cope with the requirements of different types of buildings (e.g. houses versus flats), fluctuating occupancy rates and changes in behaviours, which may include the use of different types of mechanical ventilation systems.

Focusing on social housing enabled us to explore a wide range of buildings, from traditionally stone-built properties, through to retrofitted homes and new builds. But we were unable to explore how homes with a SAP rating of >88 (Ed. – roughly equivalent to a B1 BER) and this should be assessed in future work. We also need to overcome some of the limitations of current work by having a better definition of energy efficiency – the current SAP methodology does not account for variations in occupant behaviours and the actual day-to-day performance of a property is likely to differ from its predicted energy performance.

The extent to which a home is heated and ventilated is also largely controlled by the habits of its occupants, and the way people live in their homes varies hugely. Energy efficiency and the type of ventilation system installed needs to consider the impact of varying occupant behaviours, which can increase the indoor humidity at a property. This problem may be worsened by the type of heating system and by efforts to seal cracks and gaps, if due attention isn't given to addressing cold bridging and ventilation. That said, this sealing work may prevent vapour generated inside the dwelling from condensing interstitially, reducing the risk of unseen mould growth in the structure when combined with adequate heating and cold bridging detailing.

Crucially, we know little about how these behavioural factors contribute to damp and mould in homes that have been retrofitted to make them more energy efficient – an increasingly important issue as huge swathes of old housing stock is revamped. We believe that occupant behaviours such as drying washing on indoor racks, not using extractor fans or opening windows when showering, and not ventilating the home during colder months could partly explain our findings.

Our current study assesses how fuel poverty behaviours, use of extractor fans, perception of risk and the extent of energy efficiency affects the extent of indoor mould contamination. The findings of this study builds on our previous work and will be published over the coming weeks to raise awareness of the potential problems resulting from fuel poverty.

Richard Sharpe is a PhD researcher at the European Centre for Environment & Human Health. ***He has received funding from the European Social Fund Convergence Programme for Cornwall and the Isles of Scilly.***

[1] Sharpe, R., Thornton, C. R., Nikolaou, V. & Osborne, N. J. 2015. Higher energy efficient homes are associated with increased risk of doctor diagnosed asthma in a UK sub population. Environment International, 75, 234-244

Building quality needs top-down legislation & bottom-up leadership

*Opinion pieces are dangerous things, writes **Martin Murray**. "One accurate scientific measurement is worth a thousand expert opinions" as Admiral Grace Murray Hopper reputedly warned. But sometimes an opinion can be a useful way of airing a view which might be at best, a hunch, a value judgement, or maybe even a scientific fact.*

Passive house is nearing 25 years of scientific facts, and so the question for practitioners today is how we can best link exemplary construction with everyday building practices and on-site behaviours. Top-down legislation – as per Ireland's recent building control regulations — is little use without a bottom-up transformation in the way we educate our workforce and commission, tender and construct buildings. We urgently need significant social housing yet we have ungainly legislation and a dearth of leadership. This piece is based loosely on the following facts, value judgements and hunches. Which is which, I leave to the reader.

1. Small decisions are often agonised over, while really big decisions are made with abandon. Significant policy decisions, particularly when politically opportune, rarely get the scrutiny and circumspection they deserve.

2. The really difficult things in construction are full of small decisions. The person making decisions on site should be encouraged to take responsibility for them.

3. Trying to design a low energy building without adequate airtightness is akin to watering a garden with a sieve. The intentions of Part F (ventilation) of the building regulations are not aligned to Part L (conservation of fuel and energy). Excess renewables are not an adequate substitute for poor construction.

4. The 23% Vat rate on professional services (such as passive house design) negates the use of such knowledge, denying future generations of the long term benefits. All insulation materials should also be zero Vat rated.

5. Sub-contractors do not a good main contractor make. PPPs are not a panacea for quality or effort. Low tenders destroy cooperative construction.

6. You cannot change a building control system in two years. The entire Irish system needs to be significantly re-thought, while educational, professional and training systems require time to change.

7. Ireland's new building control system is a privatisation of risk, and a deskilling of local authorities. (In line with the fact that Ireland is one of the most politically centralised administrations in Europe.)

8. Good politicians are good at being re-elected; everything else is a bonus.

9. Government departments protect their own budgets first. Cooperation with other departments does not appear to be part of their default value system.

10. Construction quality is a challenge from the bottom up as much as from the top down. We need a strategy to meet in the middle; blue collar and white collar makes green collar.

11. Many skills within the construction industry can only be taught through apprenticeship. Architecture might well be one. In 2014 only four plasterers in Ireland registered for apprenticeship.

12. Dublin is Europe's capital city for solar space-heating suitability. A house in Ireland can meet more than 20% of its space heating demand through solar for eight months of the year, versus seven months in Hamburg and six in Frankfurt.

13. More people die annually as a result of bad housing than die on the roads, or by suicide. We need to ask why this is not a priority issue for society to address.

14. Every €1 spent within communities to create good low energy social housing returns €3 to €4, based on savings made against fuel poverty, hospital stays, better health outcomes, job creation and increased disposable incomes.

15. Addressing why people die due to bad housing requires money, effort, sweat and maybe tears. It needs government departments to talk to each other - Health, Social Protection, Environment, Energy, Finance and the Prime Minister. One suspects this isn't happening.

16. 'Professionalism' is dead, killed by lowest cost tenders. Professional institutes have become mere trade unions for their members' interests. They might be better served by being more vocal advocacies for their communities.

17. If professionals cannot shout 'stop' against building control regulations which are paper heavy, legally fraught, expensive to implement and not fit for the consumer, then who does?

18. Lowest tenders are not necessarily better. Average tender values give a more accurate reflection of true project costs and also 'professional' services.

19. Architecture in general is neither a fine art nor utilitarian engineering, it is a craft-based skill combined with intelligent, beautiful design. Good construction is the result of collaboration, communication and shared values, not competition.

20. No amount of inspection plans, site inspections or occupancy certificates will protect a project against a craftsperson with the attitude: 'I am only here from the neck down'. To quote Admiral Hopper again, "you manage things, you lead people".

21. Good low energy buildings start with south facing strategies. Planners need education in low energy design and site planning.

22. Front doors don't always have to face the public road. Windows don't have to ape traditional construction. Comfort, low energy and good design are mutually inclusive.

23. Fenestration can be aesthetically subjective; in PHPP, fenestration is objective regarding energy use. If north points have to be shown on plans let them be relevant to the design. Inappropriate orientation costs money.

To achieve real build quality we need a regulatory control system that rewards scientifically verifiable strategies such as passive house. We need a system that helps develop design skill-sets and apprenticeship pathways through a stable industry, addressing fuel poverty, attracting low property tax and meeting local regulatory requirements. We need a planning control methodology that allows strategic construction-stage revisions to refine energy use and focuses expenditure not just on paper trails but on good construction, adequately paid for by real average tender procedures. We need contractors with verifiable construction skills, rewarded for having permanent specialist staff and project management skills, and answerable to a trained and supported local building control authority, in turn supported by a planning authority willing to intervene within the free market to control ill-considered applications. If we actively support design influenced by science we may yet bridge the gap between blue and white collar and create a green collar construction sector that holds its rightful place within the economy of a country, as opposed to being its economic flywheel. A top down legislative environment without responsible contracting, bottom-up skills and verified design strategies serves no good.

Martin Murray is an architect in private practice. He is a director, former chairman and founding member of the Passive House Association of Ireland. The views expressed here are his personal opinion.

INTERNATIONAL SELECTION

This issue's international selection of passive and low energy building includes two homes built for retirement — one in Austria, one in New Mexico — a striking house in a Romanian forest, and an out-of-this-world passive-certified dome in tropical south-west China.

Photos: Halodome (HK) Ltd

Halodome, Goaming, China

Words: Kevin M Neary, passive house designer & chartered building engineer

This project started in 2010, when we were asked by Halo, the luxury furniture designer and manufacturer, to design a modular timber frame dome that could be made in China and exported as a kit house. Initially we planned to use glulam beams to create the curved structure, but soon realised they would be difficult to package into a container and erect on site. We then developed a trapezium dome design, where we could make the size of the panels manageable.

The design consists of four panel sizes which stack on top of one another to form each segment, and there are 20 segments per dome. One layer of panels forms the insulating zone, and contains both mineral wool and phenolic insulation. Each panel face is flat, so we needed to provide curved battens on both the inside and the outside to create the smooth lines of the dome. Once the structure was designed, we started to think about the insulation requirements required for our client's target market.

We attended a seminar run by the Passive House Academy, which gave us the tools required to design the building to passive standard for a temperate European climate. Upon certification of our design, Halo commissioned the construction of a prototype in south-west China, which has a tropical climate. This meant the dome would have to be designed for cooling rather than heating (the prototype's annual space heating demand is zero, but its cooling demand is 42 kWh/m^2/yr).

This presented challenges, in particular for the membranes. Halodome includes a vapour control layer on the outside of the build-up to prevent moisture flooding into the structure. Shading was also an issue due to the heat gain from sunlight, but this was overcome with sunlight-controlled shutters. The main problem was heat recovery ventilation, as we struggled to find a product which could address the humidity of the incoming air. Fortunately time caught up with us, and Paul designed a new MVHR unit (the Novus 300) with humidity recovery. The project was certified as a passive house in October 2013, and was the first domestic certified passive house in China. Halodome (HK) Limited have now started volume production of the design from China, with the first orders due to arrive in Denmark in May 2015, though not all will necessarily be to the passive house standard. ▸

Photos: Tecto Arhitectura

Passive House Che, Suceava, Romania

On this project, the challenge for Bucharest-based Tecto Architects was to create a simple, sustainable, two-storey home on a rather special site: a mature forest within the city of Suceava, in northern Romania. Naturally for a passive house, the building's form and orientation are designed to maximise daylight and solar gain through south-facing orientation. Siting the house on an elevated slope helped to achieve this, and to provide views over the forest.

To match its surroundings, the house is clad externally with cedar slates, while a green roof helps to recover the natural surface displaced when the house was built. The design of the house is based around a central glazed courtyard, allowing the building to communicate with its natural environment. This glazed core incorporates the stairs, hallways, and according to the architects, "spaces where one can feel outside although inside".

The timber frame walls are insulated with cellulose and woodfibre board, and protected with intelligent vapour membranes. The client chose not to have the house certified by the Passive House Institute, but it seems to tick all the right boxes: it was designed with PHPP, has a space heating demand of 14 kWh/m^2/yr, and airtightness of 0.4 ACH.

A small gas boiler distributes heat to radiant underfloor and wall heating panels, while the sitting room also has a standalone wood chip stove. As well as mechanical heat recovery ventilation, the house also has an earth-to-air heat exchanger that draws on the free constant temperature of the ground throughout the year, cooling incoming air in summer, and preheating it in winter. The owners are planning to put in a solar PV system to generate their own electricity too. ▶

Photos: Needbased

TAOsHouse, New Mexico, USA

Long-time Taos, New Mexico residents Ross and Kristin Ulibarri looked to the future with TAOsHouse, a 'prairie-style' certified passive house located in a co-housing community. The house was designed to ensure the couple, in their mid-sixties, can actively enjoy this mountain town and live at home for decades to come.

"We not only wanted a beautiful home, but we were also interested in furthering sustainable housing by building a cutting-edge home," says Ross. Designed by Sante Fe-based passive house designers Needbased Inc, the house has timber frame walls and a roof that are insulated with both cellulose and EPS, delivering U-values better than 0.10. Airtightness is 0.42 air changes per hour, space heating demand is 11 kWh/m^2/yr, while the heat load is 9 W/m^2. Meanwhile, a solar PV array on the roof means TAOsHouse's net energy use is zero.

"Energy conservation and efficiency are designed into a passive house from the beginning, versus relying on complex systems to make it comfortable or reduce its energy use after it's built," says Jonah Stanford, Needbased's principal. "Mechanical systems cost money to repair and replace. The fundamental performance of a passive house is just based on physics and conservation — and it is more enduring and less expensive to conserve energy than it is to create it."

The Ulibarris chose to build their new home at Valverde Commons, a 28-home co-housing community. The site's common house includes a shared kitchen and space for meals, classes and events. The community surrounds a shared meadow and borders 10 acres of farmland, community gardens and public-access open space. And the view isn't bad either, with TAOsHouse's expanses of triple-glazing framing views of nearby Taos Mountain. ▶

White Pine Bungalow, Althöflein, Austria

This project came about in February 2013, when architect Thomas Abendroth took part in a "speed dating" session with prospective clients at a construction exhibition in Vienna. There he met the Späths, a couple looking to build a home for their retirement. Their seven-minute meeting would ultimately lead to the creation of White Pine Bungalow, a striking low energy house in Austria's wine region.

The clients were keen to minimise the house's impact on the environment, so Abendroth adapted a passive house approach. The timber frame is heavily insulated, with U-values for the walls, roof and floor all 0.11 or better. Besides this, the house is orientated to the south, has triple-glazing and heat recovery ventilation, and boasts air-tightness of 0.59 air changes per hour. But the unfavourable surface-to-volume ratio means it

Photos: Andreas Buchberger

didn't quite meet the passive house standard, with space heating demand and heat load coming out at 25 kWh/m^2/yr and 20 W/m^2 respectively.

Inside, a ground source heat pump provides any additional heat needed for the open plan spaces. Outside, the house is clad with vertical white fir slates in different dimensions and arrangements, creating a lively facade that the sun bounces off to create different conditions of light and shade. An overhanging roof to the south, and aluminium shutters to the west, provide protection from glare and overheating.

There are two outbuildings on the site, while fencing that matches the facade of the house wraps the perimeter of the whole residence, hiding a terraced private courtyard designed by landscape architect Joachim Kräftner. The couple wanted the house to be fit for their retirement, so everything sits on one level. There's even a separate entrance — with its own shower and a mudroom — for when the Späths come back from a long hike with their dog through this region of farmland and rolling hills.

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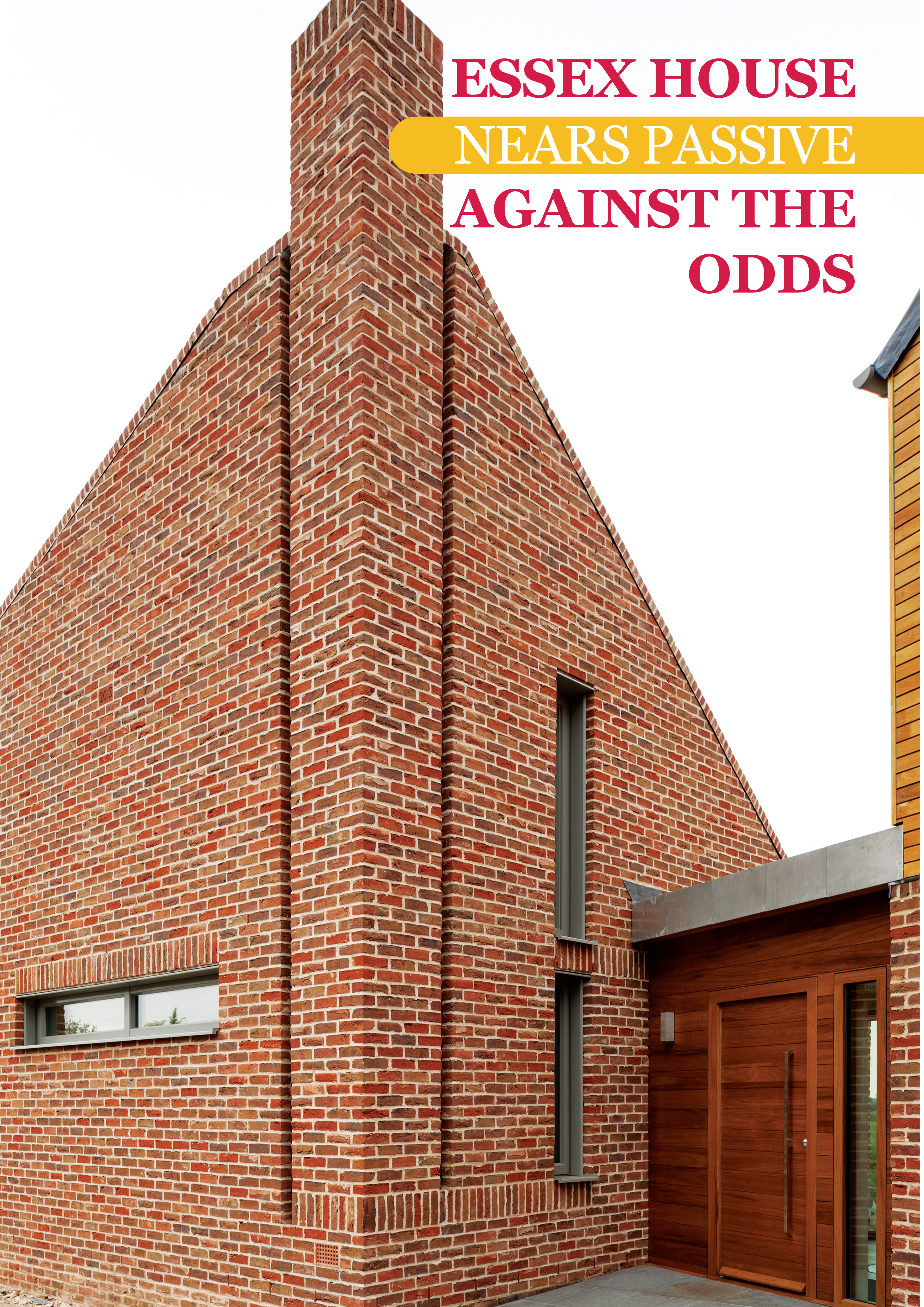
ESSEX HOUSE NEARS PASSIVE AGAINST THE ODDS



Photos: Andy Stagg

When Mike Jacob of Trunk Low Energy Building started planning to build this unique Essex home, it seemed likely to run way over budget, and still fail to meet the passive house standard. But rethinking key details and making tough compromises got the house within touching distance of passive, while slashing costs.

Words: Mike Jacob, Trunk Low Energy Building

It's not unusual for us, as a project management and low energy building consultancy, to be presented with designs that have not been tested from either a cost or energy perspective.

In fact it is unusual to be presented with one that has. Passive House Plus readers might find this surprising, but we often find ourselves being the bearers of bad news to clients who have spent months, and sometimes years, investing emotionally and financially in a design for their new home.

The Knights Hill project in Essex is perhaps the most striking example of a budget and performance gap we have seen in the last five years. The fact it is now completed with happy clients also makes it one of the most satisfying challenges we have overcome.

When we first met Jason and Lucy Reeve they were somewhat jaded by a frustrating planning process, but had a hard-won consent in their hands and the enthusiasm and drive to build their ideal home.

They wanted to benefit from the inherent savings of a project-managed solution rather than a main contractor, and were referred to Trunk Low Energy Building. They were already committed to a timber frame build from Touchwood Homes, a local company with experience delivering to the passive house standard.

Our first task is usually to generate cost and energy models, if none exist. This gives everyone involved clarity and provides a focus for all necessary decision-making. In this instance, Rod Williams of Williams Energy took care of the PHPP modelling and we focused on the detailed costings.

The point to keep in mind, for anyone yet to plan their build, is that both these pieces of work were done after planning permission had been granted. This is too late. The cost and energy analysis should be embedded into the pre-planning stage to ensure the scheme that is submitted works on all levels. The client's emotional investment in the design is then based on its viability.

We try to emphasise this to clients whenever we join a team earlier on in the process – and although there is no doubt that there are teams out there who work this way as standard, the norm in our experience is either a 'hope for the best' strategy, or an over-reliance in their budgeting on superficial cost estimates that are not sufficiently detailed and end up inflating during the build.

In broad-brush terms, the scheme we costed in this instance was almost double the client's budget. The passive house performance targets were not being met either. Although the design was close, it was not close enough to be certified, mainly because the shape of the house is complicated and inefficient. There were also some overheating issues that had to be dealt with.

There are various strategies that can be employed in situations like this. The Reeves opted for the most ambitious — as far as testing the art of the possible, and their own input as hands-on clients was concerned. Rather than give up or take a deep breath and go back to ▶

(above) a combination of Sussex chestnut cladding and handmade bricks clad the exterior walls, while the front door is fully passive house certified, from Urban Front; (below) the complex shape meant it would be harder to achieve the passive house standard; (p35, bottom l-r) the Viking House passive slab foundation system virtually eliminates the critical wall to floor cold bridge; two different stages showing the erection of the timber frame on top of the insulated slab

planning with a revised scheme, they wanted to find a way to make the design they had grown to love work, even if it was at the expense of a few kWh/m^2/yr.

We began the process of appraising alternative, more cost-effective options, for the big-ticket items — those which would have no negative impact on building performance. We worked closely with Rod Williams, who refined the PHPP model and also developed several iterations of the wall to floor junction in the Therm software, in particular around the top of the basement walls, to test the use of ICF instead of a pre-cast system. We found that we were able to sit the sole plate on a strip of high density EPS which spanned the top of the concrete core. This virtually eliminated an otherwise significant thermal bridge and gave us confidence in pursuing a solution that was substantially cheaper than the one initially designed, in part due to the method of construction, but also due to the way it was procured. This gave us a saving of approximately £70,000.

We undertook a lot of work liaising with suppliers and warranty companies to interrogate the structural waterproofing system. In the end Kryton waterproof concrete and Integraspec ICF gained type approval with Checkmate, which allowed us to omit the expensive tanking solution from the scheme, saving approximately another £10,000. We also found a highly satisfactory glazing solution from Norrsken, which stacked up on all fronts against the initial preferred supplier, and again saved money without impacting on performance.

The M&E solution was stripped bare to a simple LPG boiler delivering hot water to towel rails and a heating element in the MVHR system. There is also electric underfloor heating in wet rooms, and the obligatory wood burning stove and solar thermal – but previous notions of underfloor heating throughout the house and heat pump or biomass solutions were abandoned, following lengthy discussions with passive house consultancy Warm. This saved around £20,000.

Beyond the focus on 'big stuff', the Reeves embraced the principle that if they really wanted to build this design within their budget, they would have to get stuck in and make compromises. They undertook all decorating themselves, and delayed their green roof and all the soft landscaping. They purchased site accommodation and security items to be resold at the end, opted for Spanish rather than Welsh slate, stripped back the M&E, and put to one side aspirations for on-site energy generation.

Funds were focused, above all else, on getting the fabric right and then making careful material choices of a high quality that would last a very long time— such as natural stone flooring, Sussex chestnut cladding, terne-coated stainless steel and an Urban Front passive certified front door.

The airtightness target of 0.6 ACH was met. There were niggles with water ingress in strange places, which we resolved, and there was some fine-tuning required to the heating and ventilation systems. The Reeves have now lived in their forever home for almost a year and are very happy. We intend to stay close to them to ensure that this remains the case for years to come.

Mike Jacob is a chartered construction manager and certified passive house tradesperson, and is managing director of Trunk Low Energy Building ▶

PROJECT OVERVIEW:

Building type: 250m sq m detached timber frame house with ICF basement

Location: Essex, England

Completion date: March 2014

Budget: £500,000 approx

Passive house certification: not certified

Space heating demand (PHPP): 17 kWh/m²/yr

Heat load (PHPP): 12 W/m²

Airtightness (at 50 Pascals): 0.6 ACH

Energy performance certificate (EPC): B 86

Thermal bridging: Y value in SAP was 0.005. Extensive work was undertaken in conjunction with Williams Energy to eliminate the basement to timber frame sole plate thermal bridge, and wall-floor junction elsewhere. The rest of the frame included details which are already thermal bridge free. The basement junction incorporated a 50mm horizontal strip of EPS 300 sitting in the 200mm concrete core at the top of the ICF walls. The 300mm sole plate sat directly on this with 100mm of the sole plate projecting beyond the concrete core and hanging over the EPS in the ICF walls. The wall to floor junction elsewhere was maintained as thermal bridge free using a 300mm fully filled I-beam system sitting on a Viking House Passive slab with EPS 300 perimeter upstand.

Ground floor: Viking House Passive slab, certified by the Passive House Institute, with 300mm EPS and EPS 300 perimeter detail. U-value: 0.10

Walls: Touchwood I-beam system timber frame system with 300mm Warmcel insulation. External sheathing & airtight layer formed from 16mm Ageapan DWD board, sealed with butyl sealant. 22mm chestnut cladding and handmade bricks form the exterior. U-value: 0.10

Roof: Same roof build up as walls with Spanish slate and tern coated stainless steel roof covering externally. U-value: 0.10

Windows & sliding doors: Viking Window alu-clad triple-glazed Passiv windows. U-value: 0.7

Front door: Urban Front E98 Passiv insulated door in iroko. Passive House Institute certified. Installed U-value: 0.8

Heating system: Vaillant Ecotec LPG boiler & Kingspan solar thermal collectors feeding Gledhill cylinder, which supplies domestic hot water and feeds towel rails and a heating coil in the MVHR supply air. Bathrooms also have electric underfloor heating. Also Morso S10-40 wood burning stove.

Ventilation: Zehnder ComfoAir 550 MVHR. Passive House Institute certified heat recovery efficiency of 84%.

Green materials: cellulose insulation, recycled materials for back-filling around basement, Polyagg recycled EPS waste in place of granular fill around basement, UK sourced coppiced chestnut cladding, Osmo UV natural protection oil for timber cladding, ecological paints.

SELECTED PROJECT DETAILS
Clients: Jason & Lucy Reeve
Project management & QS: Trunk Low Energy Building
Timber frame: Touchwood Homes
Energy consultant: Williams Energy
Architect: Kirkland Fraser Moore
Civil & structural engineering: Michael Evans & Associates
Mechanical contractor: Baystar
Airtightness tester: Airtightness Testing UK
Cellulose insulation: Warmcel
Airtightness products: Pro Clima
Windows & sliding doors (supplier): Norrsken
Windows & sliding doors (manufacturer): Viking Window AS
Front door: Urban Front
LPG boiler: Vaillant
Wood burning stove: Morso
MVHR: Zehnder
Rainwater harvesting: Rainwater Harvesting UK
Electrical contractor: ETS
Cladding: Inwood
Lighting: Sam Coles Lighting
Passive house slab: Viking House (produced by Airpacks)
ICF Basement: Integraspec

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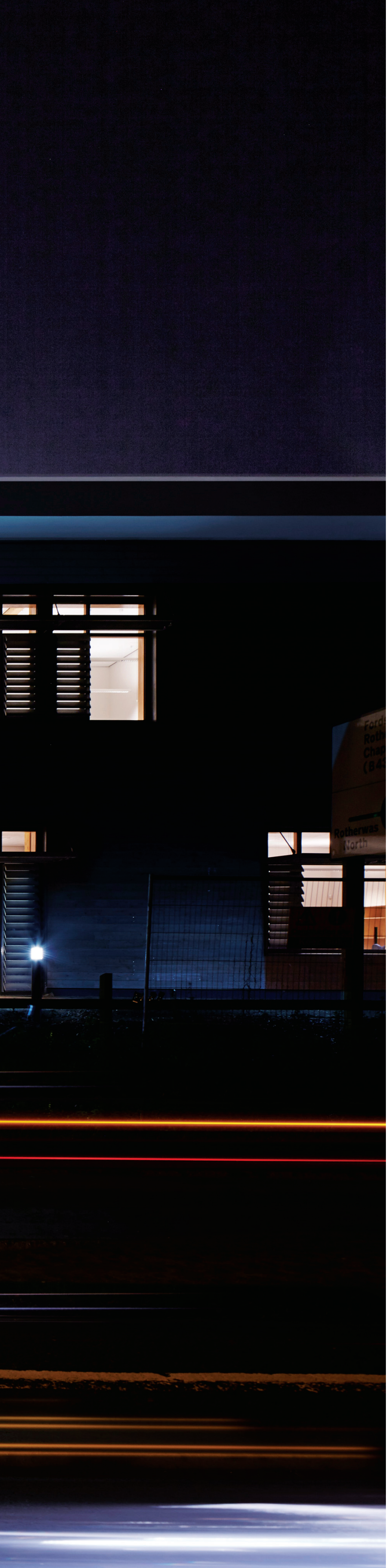
Hereford archive CHOOSES PASSIVE PRESERVATION



Safeguarding historic documents and other artefacts requires stable building conditions. Until now this was usually achieved with the expensive and energy-hogging use of heating and cooling equipment, but a new approach by Herefordshire Council used the passive house approach to conserve energy, money — and the county's precious historical archives.

Words: Kate de Selincourt

With its ancient black-and-white cottages, and medieval churches and barns, Herefordshire is a county packed with history – and to match that, extensive archives on paper, wood and cloth. Its collection includes medieval maps and manuscripts, paintings, sculptures, even Anglo-Saxon construction timbers, plus "an awful lot of newspapers".

A few years ago. Herefordshire Council realised it had a problem. Its archive accommodation was not up to the standards needed to preserve the contents safely. It would have to build a new repository that met the standard required, or the entire collection would go out of the county and be archived elsewhere.

But an archive building does not come cheap. Arts Council England recently suggested the build cost of a public archive is around £3,600 per square metre. Nonetheless, Herefordshire set about procuring a building that would meet the required climate control standards, within the tightest budget possible.

Passive house design specialists Architype were approached to submit a design for the building, which would include a repository for the collection plus offices, labs and exhibition areas. The firm teamed up with passive house specialists Nick Grant and Alan Clarke and — along with Kier Construction and E3 engineers later in the process — they investigated what could be achieved.

The materials in an archive require stable conditions – not too warm, not too cold, not too dry and in particular, not too damp. Temperatures should be between 14C and 19C, and relative humidity close to 50%.

There are not many days of the year when these are the outdoor conditions, so modern archives tend to feature heating for the winter and cooling in summer, and both de- and re-humidification equipment, all controlled by a building management system.

However, there can be problems with this arrangement. As lead architect Mark Barry recalls: "We looked at some critically acclaimed archives, and we found out that not only had they been expensive to build, they also used a huge amount of energy and so were really expensive to run – some had bills in the order of £80,000 to £100,000 a year.

"Speaking to the facilities managers we found many had problems, such as plant running high too often. Sometimes repositories were even having to be emptied because they got too warm."

Nick Grant believes that problems like this are inherent in complex building services set-ups. "The more complexity you have, the more chance there is of unforeseen effects and gremlins. Weird stuff happens; even when a building appeared to be working perfectly when it was commissioned, the conditions change, and something unforeseen kicks in," he says.

In the light of these problems, combined with the very constrained budget, Architype and their colleagues went back to first principles to rethink everything from scratch. By good fortune, at around the same time the British Standards Institution (BSI) published its new guidance on archive storage facilities. Although the basic temperature and humidity requirements were unaltered, there was a new acknowledgement of the need to save energy, and a fresh insight that it was not necessarily a fixed optimum point that was important, but protection from sudden changes in conditions. ▶

Photos: Dennis Gilbert/View Pictures Ltd

(below) the contents of the archives should provide ample buffering to ensure there are not unwanted swings in humidity, but by adding the conditioning the air in the archive can be directly controlled as well

And this is exactly what you see in a passive building: the airtight fabric and high levels of thermal insulation keep the inside isolated from the vagaries of outside conditions — just what is required in a repository.

Some initial calculations were done by Nick Grant, who modelled conditions in a notional repository: a reasonably large three-storey, highly insulated, highly airtight box. “Looking at weather data and assuming a small amount of heating to keep temperature above 14C, we found that on average, the conditions would even out to those that were required: the slightly more humid air in summer would be balanced by drier air in winter,” he says.

Nick also drew inspiration from another building physics expert. “Tim Padfield’s analysis suggests that because of the large buffering capacity of the building and even more so, the archive itself, and the storage boxes, the stored material would stay safely within the parameters required,” he says.

These initial calculations convinced the team that the passive house approach would be the right one for Herefordshire’s new archives, and a

proposal began to take shape. Although archival records, like human occupants, enjoy the steady temperatures that passive house design can offer, there are important differences.

In a passive house occupied by people, there is a high ventilation rate – to remove the high quantities of moisture and pollutants generated by people doing people things. Hence the use of MVHR units that can pre-filter the air, recover the heat, and replace polluted air with filtered fresh air at a comfortable temperature. By contrast, an archive produces virtually no pollution, and is only visited occasionally to store and retrieve documents. So very little ventilation is needed, which means the influence of external conditions can be minimised too.

The team was confident that with their experience of designing to the passive house standard, they could build an extremely airtight building, and use the minimal fresh air requirement to slightly pressurise it with filtered air. This would virtually eliminate uncontrolled infiltration — ▸

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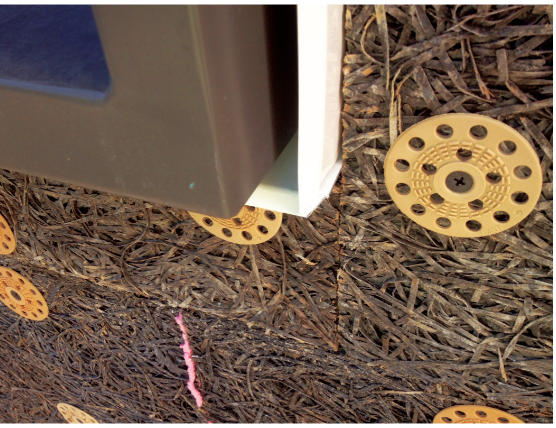

(top) part of the Limetec system that clads the timber frame building; (above) the timber frame structure from Cygnum was fully filled with Warmcel insulation; (below) the two parts of the building, concrete and timber frame, sit side-by-side, but are thermally independent; (bottom) the repository itself is basically a big concrete box with a Warmcel-insulated larsen truss system externally, covered here in Bitroc board; (P39) the timber building has a generous amount of glazing to make the most of the views outside, with shading above each run of glass to minimise summer overheating

and hence minimise the need to remove any heat, cold or moisture that outside air would bring in.

This approach is strongly endorsed in the new BSI guidance. As Architype's Mark Barry explains, this advice grew out of the experience of the archives inspectorate, which monitors a lot of archive buildings and observed that more thermally massive and airtight buildings (often the older ones) are a lot more stable, and give a much longer safety margin if plant malfunctions. The guidance underlines the importance of airtightness, and as M&E lead Andy Jarvis of E3 explains: "Airtightness was a critical part of the strategy, and we achieved an airtightness of 0.35 ach at 50 Pascals over the whole building."

Close teamwork between the design team and contractor Kier, to deliver such a tight building, was a pleasure, Nick Grant recalls: "This was a real two-way process that moved everyone's knowledge forward. Project manager Jeremy Mann rose to the challenge and achieved an outstanding result, often rolling up his sleeves to do some of the more fiddly details himself."

Alongside the complexity, another problem found in many archive buildings is heat leaking into the archive rooms from adjacent spaces occupied by staff and public visitors.

As Architype's Mark Barry observes:" You can get separate bits of conditioning plant in adjacent parts of the building basically fighting each other: if archives and office spaces are not thermally completely separated, you get the cooling system fighting to cool one part of the building, with the heating next door fighting to warm it up the other side of the wall, and this spirals until both plants are going flat out. No wonder the bills get so high."

This situation can be exacerbated because it is common for archive buildings to devote an entire floor at street level to offices and public spaces. Isolating one storey of a building thermally from another – especially if there is a heavy structure higher up – is extremely difficult, because of the need for a strong structure to pass right up through the building. But in Hereford, the team proposed to tackle this very simply – by placing the two parts of the building side-by-side, with a fully insulated cavity between, allowing them to operate independently.

The temperature in a passive house does change noticeably in response to the sun: and this tends to be welcomed in winter, though sometimes solar gain is limited by shading in summer. However an archive is really a lot better off kept in the dark, so a windowless block was proposed for the repository, removing those fluctuations.

The team was convinced their approach would work well, would use spectacularly less energy than the norm, and would cost less to build as well. There was nevertheless pressure to cling to the 'standard' route: to design a heavily conditioned archive and then, because of the council's ambitions for sustainability, to install renewables to 'offset' the energy use, in order to reach the Breeam Very Good standard. A crunch point came when the budget hit a wall, and it looked as though there would be no new archive, and the collection would be sent out of the county after all.

But Architype and their colleagues were able to offer Herefordshire Council a way out. "We said to the client if you go for passive house instead of Breeam, we will be able to design a much more stable building with very low energy use, with very little to go wrong," Mark Barry recalls. The passive house scheme was costed, and showed an estimated 4.5% saving on build costs, plus around £60,000 a year in running cost savings, compared to other facilities built to current standards."

The council said yes, and the Herefordshire Archive and Records Centre (Harc) got under way, with construction starting in August 2013, and a staged handover beginning in late 2014.

As Andy Jarvis of E3 explains, the quality of the fabric is what ended up saving the money: "In a 'standard' archive, control systems are needed to counter influences on the space from heat and cold, air, lights, and people — you then need the dehumidification, cooling etc of the spaces. We are keeping these influences out and avoiding all that expense. We were able to deliver this at a very low price, well below the benchmark for this kind of facility."

Jarvis says there is a big difference between the new and old British standards for archives. "The upgrade [in standards] is a very good thing! It recognises that passive design is more advantageous and points to [thermal] mass, high insulation, and to controlling inputs — of air in particular via airtightness, also light and so forth.

"It also nods towards the ability for conditions to move alongside seasonal changes, allowing the conditions to float within a band. It's a more flexible approach, and was a key element in allowing the client and the team to think how spaces would work seasonally, rather than seeking rigid all year round control."

However as this building is — we believe — the first public archive to be designed and built to these new standards, the team also undertook extensive modelling: "We analysed the design under a huge range of parameters," Andy Jarvis recalls, putting it though its virtual paces across all kinds of conditions. "The building is meant to last a very long time, so we modelled its behaviour against London climate data as well as Hereford's, to simulate its behaviour in a changing climate."

Although everyone was keen to understand the figures, the passive house approach also chimed with the archivists' own experience. "It was great to have the archivists as part of the team; they gave valuable inputs from their experiences with other buildings," Andy Jarvis says. "They appreciated the benefits of a more passive approach, having had experience with more complicated systems."

As a result of the modelling E3 added the capacity to cool and dehumidify the minimal amount of supply air, so that internal conditions would stay on target during a hot humid summer.

"We believe that the contents of the archives will provide ample buffering to ensure there are not unwanted swings in humidity, but by adding the conditioning we can directly control the air in the archive as well, to give additional reassurance to the client," says Nick Grant.

The small amount of heat required in winter (around 1kW to each floor) is provided via air which is recirculated through small air handling units, keeping plumbing out of the archive storage rooms. Recirculation was used because the fresh air ventilation rate required is too ▶

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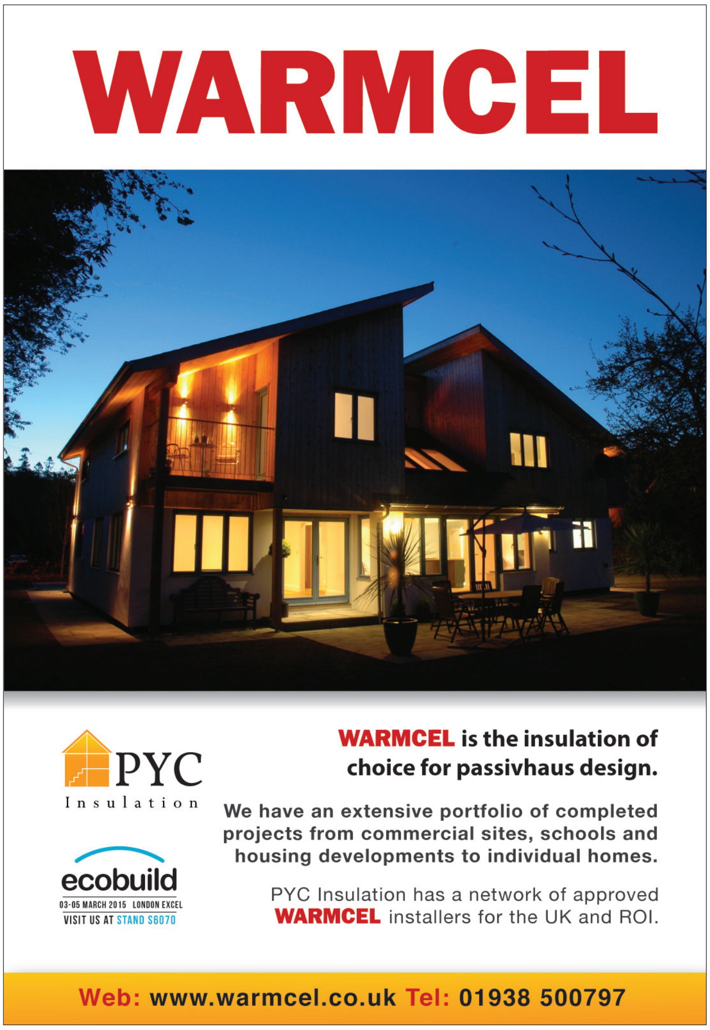

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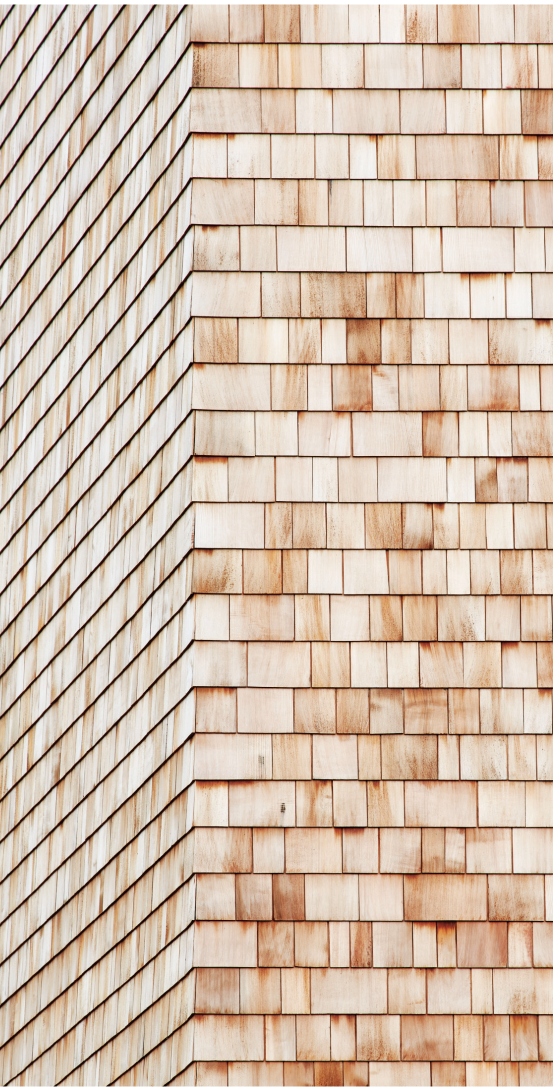

small to deliver sufficient heat, and minimal ventilation is key to the stability of the interior.

At the front of the building, thermally separate from the archive, are the new offices, exhibition spaces and conservation labs. Built by Irish timber frame manufacturer Cygnum – whose work on Architype's passive house projects includes the Oak Meadow & Wilkinson schools, and the forthcoming UEA Enterprise Centre – this part of the building is clad in lime render, and there is also generous glazing to make the most of the views outside, with shading above each run of glass to minimise summer overheating. Manually openable louvered lights with insect mesh allow for natural ventilation in hot weather, while a gas boiler also heats this space via radiators.

The repository itself is basically a big concrete box, but Architype wanted the occupied part of the building to look softer and more attractive. "We found that a vertical cedar shingle cladding was pretty much the cheapest of the options we looked at. It's a beautiful material, and will be slowly weathering down to silver," Mark Barry says.

The whole team is now enthusiastic about putting their experience in designing the archive into practice elsewhere, and perhaps making an even simpler building next time: "Our experience with passive house is each time we revisit a basic design type, things have got simpler and better," Nick Grant says. "We were able to do this with the schools, so hopefully if we get the chance to design another archive, it will be even simpler."

Andy Jarvis now wants to take this approach to archive design forward: "The new guidance and passive house have come together and led to a new way of doing this, it's definitely the way to do it in the future." Herefordshire has effectively led the way, he believes. "I think this is great for the client because they were in a difficult position, struggling financially, but they stuck with it, and now they have something they can show off."

SELECTED PROJECT DETAILS

Client: Herefordshire Council
Architect: Architype
M&E engineer: E3 Consulting Engineers
Contractor: Kier Group
Civil & structural engineering: Eastwood & Partners
Energy consultant: Elemental Solutions
Energy consultant: Alan Clarke
Project manager: EC Harris
M&E contractor: Axiom Building Services
Airtightness tester: HRS Services
Timber frame: Cygnum
Cellulose insulation: Warmcel
Cellulose insulation installer: PYC Insulation
Floor insulation: Jabfloor
Airtightness products: ProClima & Siga
Windows, doors & curtain walling: Pacegrade
Roof windows: DVS Ltd
Cladding supplier: M Camilleri & Sons
Screeds: Avonline Flooring
Sheathing boards: Warren Insulation Ltd
Plasterboard: Gyproc
Ventilation: GEA Heat Exchangers Ltd.
Condensing boilers: Vaillant

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PROJECT OVERVIEW:

Building type: 3,350 sq m detached three-storey public archives centre comprising timber frame offices and monolithic concrete building.

Location: Rotherwas, Hereford, Herefordshire, UK.

Completion date: Jan 2015

Budget: £8.1m (total) £6.35m (building only)

Passive house certification: pending

Space heating demand (PHPP): 12 kWh/m^2/yr

Heat load (PHPP): 13 W/m^2

Primary energy demand (PHPP): TBC

Airtightness (at 50 Pascals): 0.36 ACH

Energy performance certificate (EPC): B 31

Ground floor
Timber building: Floating raft, below raft 250mm of Jabfloor EPS insulation. U-value: 0.10
Concrete building: Strip footings with 150mm of Jabfloor EPS insulation. U-value: 0.11

Walls
Timber building: Limetec render externally on 50mm vent batons, on 18mm Bitroc, on 340mm prefabricated timber frame from Cygnum, fully filled with Warmcel insulation. U-value: 0.13
Concrete building: Cedar shingles externally, followed inside by 100mm vent baton, Bitroc board, 300mm larson truss fully filled with Warmcel, on 215mm concrete block with internal sand and cement parge / airtightness layer. U-value: 0.13

Roof
Timber building: Single ply roofing membrane, on 18mm plywood roof deck, on ventilation firrings, on breather board, on 400mm I-joists fully filled with Warmcel insulation, on 18mm OSB and Duraline, ceiling finishes to suit. U-value: 0.10
Concrete building: In situ reinforced concrete roof slab with tapered EPS insulation over, with single ply membrane covering. U-value: 0.11

Windows: Gutmann Mira Therm 08 triple-glazed timber aluclad windows with Swisspacer. U-value: 0.8

Curtain walling: Raico Therm+ H-I alu-clad timber curtain walling system. Passive House Institute certified advanced component. U-value: 0.84 to 1.0

Roof lights: 10 Lamilux FE Energysave roof lights. Passive House Institute certified advanced component. U-value: 0.84

Heating system: The building is heated using a natural gas fired LPHW system, with two circuits, one serving a radiator heating system in the office building, the other serving the repository ventilation system. Heat is generated by 2 x Vaillant Ecotec plus 624 boilers with a heat output range of 24.4 to 25.7 kW. The boilers have a NOx of 32.3 mg/kWh and are rated Sedbuk A, 89.4. Hot water is produced locally by low storage electric hot water heaters, close to the water outlets.

Ventilation: There are three types of ventilation system installed in the building. The main office building is ventilated using a GEA CL20 IVBV complete with heat wheel heat recovery class H1, 82% efficiency. Each of the repositories has a GEA recirculation air handling unit. The photo store has a more sophisticated unit, to cool and dehumidify the air to the photo store only, because of the cooler and drier conditions required there. The repositories also share a single GEA type IVBV fresh air handling unit, complete with heating, cooling and dehumidification to control conditions. All units are complete with variable speed fans and filters to suit. The systems are all controlled directly by the Trend BMS.

Electricity: While there are no renewable systems installed in the new building, the building has been designed to accept the installation of a substantial PV array at roof level should this be viable in future.

PENNINE FARMHOUSE

marries traditional style with passive performance

From a distance Steel Farm looks like a traditional Northumberland farmhouse, with its sandstone exterior and cluster of outbuildings. But inside, it is something very different.

Steel Farm is the first certified passive building in Northumberland, and the first cavity wall passive house in the north east of England. It is located near Hexham in the North Pennine area of outstanding natural beauty (AONB). Having bought sufficient land to create a 70 hectare organic farm here, but been unable to find a suitable home nearby, its owners Trevor and Judith Gospel needed to build from scratch.

While they were concerned about environmental impact, their primary goal was to build a decent, comfortable home, and to minimise their energy bills. Conscious that they had lived in bitterly cold, draughty, uncomfortable, hard-to-heat homes all their lives, they knew that they wanted something very different. After intensive research and investigation, they discovered the passive house standard, and one of its leading exponents in the UK, architect Mark Siddall of LEAP (Lovingly Engineered Architectural Process).

Start with good design

From the very beginning their aim was to preserve the character of the AONB. The challenge was achieving this without compromising on energy efficiency. The shape of a building, and the area and proportions of its windows, strongly influence both architectural character and energy performance. Detailed energy models were produced early in the design process, well before planning permission was applied for. Conditions imposed in the outline planning permission

dictated the use of natural stone for the walls, slate for the roof, and a traditional appearance. After detailed discussions with the local planning authority, the team was able to ensure these requirements did not compromise the ambition of building a passive house.

Full planning permission was received in September 2011. After this the hard work really began. While Siddall was confident that the design would work technically, he was also conscious that he had to design a home that was cost-effective. Undertaking detailed thermal bridge calculations at design stage meant it was possible to avoid the time and labour cost associated with the installation of 435 square meters of insulation. This saved Trevor and Judith approximately £3,000. Siddall says that making an investment in good design is worthwhile because it reduces construction costs and optimises energy bills. Compared to the cost of construction, he says, it is surprising how cost-effective well-considered design advice can be.

Pay attention to detail
With a high level of confidence in the design, it was then a matter of finding a building contractor that had a good track record of undertaking conscientious work. Pre-tender interviews and visits to completed projects were used to help identify suitable builders. After a number of interviews and meetings, a shortlist of contractors was selected and the project went out to tender. All relevant construction details, and the various roles and responsibilities that would be required throughout the project, were discussed with tendering parties. The winning contractor, JD Joinery & Building, demonstrated high standards of workmanship and client satisfaction, although they had not previously worked on a project that had been subject to an air leakage test.

Excellent standards of communication were critical to the project's success — as was a high level of technical awareness and craftsmanship. These needs were met through a number of factors, including the development of a comprehensive set of working drawings prior to tender, and a robust set of contract documents. A zero defects policy was developed whereby all aspects of the design were to be resolved prior to commencement on site. In total 31 drawings and schedules were prepared, and a further 64 construction details were developed.

Siddall provided training for the site manager, site foreman and each trade (stonemasons, electrician and plumber) in preparation for the work they were to undertake. Among other subject areas, these training sessions were used to develop an understanding of how to form a successful air barrier and how to install the MVHR system. As architect and certified passive house designer, Siddall undertook site inspections and offered feedback on the build quality and sequencing of the construction. JD Joinery & Building also collated photographic evidence to help verify their compliance with the design and specification.

One of the aims on Steel Farm was to use regional skills and knowledge in the design and construction, and to help foster a product supply chain for low energy buildings in the region. The project also provided an opportunity to develop cost-effective construction details suitable for small to medium sized developments, and to demonstrate that traditional materials and advanced standards of construction could be combined

(above) the external walls are clad in local sandstone followed inside by a 300mm cavity insulated with Knauf mineral wool insulation

sympathetically in an area of outstanding natural beauty. Construction commenced in July 2012 in an effort to minimise exposure to severe weather, though it ended up being one of the wettest summers on record.

proving the radiant temperature of the surfaces within the rooms. The window proportions were optimised to achieve high standards of natural daylight and solar gains. Smaller windows are located on the north, east and west elevations so as to minimise heat loss, and larger windows to the south. Window proportions were refined to reflect those of a traditional building in the AONB.

To help maintain quality Ian, the site foreman, assumed the role of airtightness and thermal integrity champion or 'Attic'. This required him to provide on-site day-to-day supervision so that convective thermal bypass mechanisms could be avoided. His role proved crucial to the project's successful airtightness result. The blower door test produced an n50 result of 0.32 ACH at 50pa (0.35m^3/m^2/hr at 50pa). Siddall says this is proof of the effort and hard work of Joe's team, especially considering it was their first ever pressure test. Patrick Doherty, the building control officer, informed the team that before Steel Farm the best recorded airtightness test result for a home in Northumberland was 3m^3/m^2/hr.

Photos: Helen Jobson Photography/Mark Siddall

In the event of a fuel shortage or power failure, the indoor temperature is not expected to fall below 16C even after five days without heating.

Super-insulated, airtight envelope
Steel Farm has 300mm cavity walls with low conductivity TeploTie basalt wall ties, insulated with mineral wool. Standard roof trusses were deemed unsuitable as they would result in unnecessary thermal bridging, so double bobtail trusses were used instead, and the roof was then insulated with Warmcel.

The use of triple-glazed EcoPassiv windows with super insulated frames from the Green Building Store helped to maximise thermal comfort by minimising down draughts and im-

Keep heating simple
A remote rural location such as Steel Farm does not have access to mains gas. After some life cycle analysis, and consultation with services engineer Alan Clarke, it was decided that LPG (liquefied petroleum gas) would be the best fuel to heat the house. Trevor and Judith now use 47kg cylinders of LPG that are fed to a modified condensing gas boiler. Steel Farm also has a solar thermal system for domestic ▶

hot water and — as foul drainage connections were not available — a reed bed system for wastewater treatment. AECB water efficiency standards were adopted in order to reduce demand for mains water and domestic hot water. This meant the use of low flow fittings, a compact pipework plan and microbore plumbing to minimise the volume of the dead legs. As an organic farm, Trevor and Judith also wanted the ecological value of the land to be maximised. Household waste is composted, environmentally friendly detergents are used and local food is sourced where possible.

Trevor and Judith want Steel Farm to be their home for the remainder of their lives, so a lot of attention was paid to how the farmhouse could be adopted to their future needs. Features to this end include: level access into the home, an oversized garage to allow easier access to the car, rooms sized for wheelchair usage, space provision for a lift should one be required in future, a ground floor office that can be converted into a bedroom, and a shower in the ground floor WC. Switches and ironmongery were placed at a level that is accessible for wheelchair users and all equipment, such as the boiler and the heat recovery unit, were placed in easy-to-access locations. A home user's guide was also produced.

A comfortable home

As of February 2013, with the indoor temperature at 20C, the calculated space heating demand of the house was 14.1kWh/m²/yr, and the building's total primary energy demand— due to the presence of some older appliances — was estimated to be 85kWh/m²/yr. However two months after moving in Trevor and Judith decided they were happy to keep the house at 18C inside, so this cut the calculated space heating demand to 10kWh/m²/yr and the primary energy demand to 55kWh/m²/yr. (Ed. – Irish readers note that primary energy figures in PHPP count all energy use, whereas primary energy figures in SEAI's Deap software discount all plug-in loads. In passive houses, that typically translates to roughly half the total, making these figures look all the more impressive, especially given the absence of renewable energy microgeneration.)

As the only two occupants, Trevor and Judith's fuel bill is estimated to be £270 per year. If the house was fully occupied, this would likely rise to about £425 per year with LPG, though on mains gas fully occupied it would fall back to £260. For a traditional, old home of similar size to Steel Farm in the north east of England, the fuel bill would be expected to be around £1250. When including the electricity use at Steel Farm, an 80% reduction in carbon emissions has been achieved compared to the average house.

Should Steel Farm suffer from a shortage of fuel or a power failure, the indoor temperature is not expected to fall below 16C even after five days without heating. This serves to preserve the health and well-being of the owners even in extreme conditions. The annual overheating risks are calculated to be less than one per cent.

The couple moved into Steel Farm during February 2013. Temperature sensors have been installed to gain greater insight into Trevor and Judith's response to living in a passive house. The 12 month monitoring programme has established that the couple are using just six cylinders of ▶

“Compared to the cost of construction, it is surprising how cost effective well-considered design advice can be.”

LPG per year. The average internal temperature during the summer did not exceed 25C and the peak daily temperature was less than 25C for 95% of the year. When the peak external temperature reached 35C, the peak internal temperature was some 6C cooler (29C.)

In February of 2015, Steel Farm became a certified passive house. Trevor says: "The construction of our new home has been a real adventure; challenging at times but, all in all, well worth the wait. Both Mark and Joe have met and exceeded our expectations. I don't think that we could have been in safer hands."

But the final word comes from Judith Gospel: "In our old accommodation, a winter or two ago, 2011 I think, we measured the temperature of the fridge and the living room. At one point it was warmer in the fridge! More than the savings in the energy bills and the reduced environmental impact, we are enjoying the comfort of our new home."

Download over £30,000 of technical papers for free by visiting: www.leap4it.co.uk/building-performance.html

SELECTED PROJECT DETAILS

Clients: Trevor & Judith Gospel
Architect:
LEAP (Lovingly Engineered Architectural Process)
Contractor: JD Joinery & Building Services
M&E Engineer: Alan Clarke
Mechanical contractor: Oakes Energy Servies
Airtightness tester: Apex Air
Windows & doors, airtightness products, MVHR & low water fittings: Green Building Store
Wall & floor insulation: Knauf
Cellulose insulation: Warmcel
Wall ties: Ancon
Blockwork: Topblock
Condensing gas boiler (converted to LPG): Broag
Solar thermal: Viridian Solar
Electrical contractor: KM Electrical Services

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PROJECT OVERVIEW:

Building type: Detached home with total floor area of 151 square metres

Location: Steel Farm, Whitfield, Northumberland

Completion date: February 2013

Budget: £275,000

Passive house certification: Certified

Space heating demand (PHPP): 14 kWh/m²/yr

Heat load (PHPP): 10 W/m²

Primary energy demand (PHPP): 74 kWh/m²/yr

Airtightness (at 50 Pascals): 0.32 ACH or 0.35 m³/m²/hr

Energy performance certificate (EPC): B 91

Measured energy consumption: The house consumed six 47kg LPG cylinders in one calendar year after occupation. Approximate total. energy usage: 1861.2 kWh/yr. Consumption for spacing heating, DHW and some (but not all) cooking: 12.33 kWh/m²/yr

Thermal bridging: Achieves a 90% reduction in thermal bridging as compared to the Accredited Construction Details and an 80% reduction compared to EST Enhanced Construction Details.

Ground floor: Strip foundation with 300mm closed cell Knauf Polyfoam Floorboard ECO XPS insulation (Standard).U-value: 0.11

Walls: Local sandstone externally, followed inside by 300mm cavity insulated with Knauf DriTherm Cavity Slab 32 Ultimate mineral wool insulation, 150mm blockwork, 18mm plaster. U-value: 0.10

Roof: Slate externally, followed underneath by trussed rafters insulated with 500mm Warmcel, 18mm OSB (taped joints), 25mm service void, 12mm plasterboard. U-value: 0.08

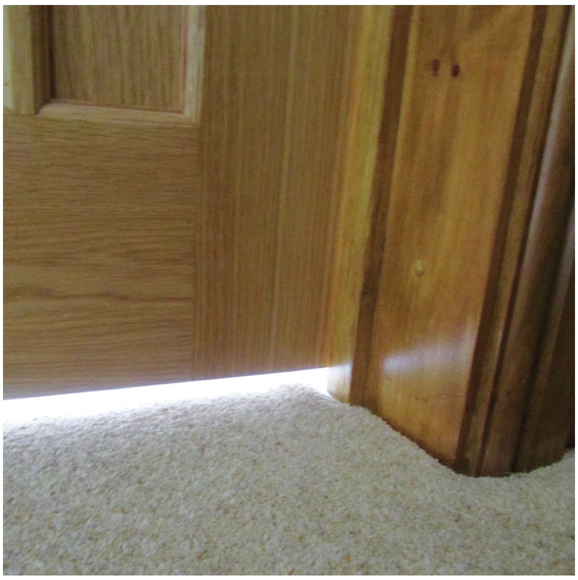
Windows: Triple-glazed Green Building Store Ecopassiv windows, (Ug=0.7, g-value 0.5), insulated timber frame, Uw: 0.76

Heating system: Remeha gas condensing boiler converted to LPG. Heat distributed to radiators. Solar thermal panels and solar thermal store (250 litres with 100mm insulation).

Ventilation: Paul Novus MVHR. Passive House Institute certified to have heat recovery rate of 93%, and a specific fan power of 0.33 W/m³.

Green materials: Stone from local quarry, all timber and timber products PEFC and FSC.

(bottom left) door undercuts provide air transfer provision and help improve ventilation; (bottom right) pipework for the Paul heat recovery ventilation system; (p47) (top left) airtightness detailing around the windows; (top right) plaster detailing for airtightness around electrics; (bottom left) low conductivity TeploTie basalt wall ties cut out thermal bridging; (bottom right) plywood boxes around the windows minimise thermal bridging



IRELAND'S FIRST

PASSIVE HOUSE PHARMACY

Late last summer, work finished on architect Paul McNally's latest super low energy project: a three-storey building in Tipperary that has just become Ireland's first certified passive house pharmacy.

Words: Lenny Antonelli

Since 1927, the Quirke family has been running a pharmacy on the main street in Clonmel, Co Tipperary. The original building on their O'Connell Street site was over 200 years old, but in poor shape.

"It was in a bad, bad state of repair," says current proprietor Ronan Quirke. "It was always my intention to do something with it."

For a start, the dispensary was too cramped for his staff. "The old space that they were asked to work in for many years was appalling," he says. The shop also suffered from a low ceiling height, poor layout and lack of insulation.

Upstairs in the three-storey terraced building was a residence that hadn't been occupied for at least 40 years, which was just being used for storage.

Quirke approached architect Paul McNally of the Passivhaus Architecture Company, who had previously designed a low energy extension to Quirke's Georgian home on Anne Street in the town.

They looked at the possibility of retrofitting, but there were so many structural issues that retaining the old building would have required serious interventions, and would have been expensive.

"To make the upper floors usable to modern standards would have taken a huge amount of work," McNally says. Meanwhile the shop was "a mess spatially. It was a nightmare really to work in, and it was freezing."

Quirke decided to knock the old building, which wasn't a protected structure, and rebuild from scratch. But he was insistent that whatever building replaced it last a lifetime — he didn't ever want to have to renovate again. "I only wanted to do this once. I certainly didn't in 20 years want to be faced with a further patch job," he says.

"I wanted to future proof it," he says. Construction costs had bottomed out at the time too, which meant he could get more bang for his buck. Quirke asked McNally what the highest standard he could build it to was, and McNally told him about passive house.

But Quirke says: "It also had to be cost-effective. I wasn't going to keep throwing money at the project just to achieve certification for certification's sake."

McNally adds: “He was pretty keen to achieve the standard, though it wasn’t an absolute requirement.”

Local contractor O’Gorman Construction, who had built Quirke’s home extension at Anne Street, was appointed here. Being in a terrace, knocking and rebuilding posed obvious structural challenges. An archaeologist was also on site at this stage of the job.

“During the planning and research, we found out that the ruins of Ireland's second quaker meeting house formed the walls of our site boundary, so we had an archaeologist on site during all the excavation and demolition works,” McNally says.

O’Gorman Construction knocked out the ground floor of the old building, before constructing a steel frame that would support both the neighbouring buildings and the rebuilt pharmacy. Once the steel frame was up, the upper floors of the old building were demolished.

“We had a very good contractor,” McNally says. “He was a great contractor we had complete faith in, he had local knowledge of the buildings on the main street in Clonmel.”

The steel frame was installed on Foamglas Perinsul blocks to avoid thermal bridging between it and the concrete slab. After demolition, work began on the new building. The team looked at various options for constructing the new pharmacy, but concrete block with an insulated, ultra wide cavity proved the most cost-effective.

The principle walls of the new building feature two leafs of 100mm blockwork, with a 250mm cavity insulated with bonded polystyrene bead, and Gyproc Airtite plaster internally. Cavities were also created by constructing single leaf blockwork walls 250mm from the party walls, and again insulating with bonded bead. In all cases, Ancon Teplo thermal bridge free walls ties were used to bridge the cavities.

The ground floor features 150mm of Xtratherm PIR insulation board under the slab, while the timber roof is insulated with mineral wool between the rafters and in the service cavity, plus an extra layer of Gutex Ultratherm woodfibre board. Munster Joinery Alu-P Passive House Institute certified windows were specified, while the front of the shop features a glazed Batimet passive house certified triple-glazed curtain walling system, supplied and installed by PJ Bowes.

The pharmacy faces south onto O’Connell Street, but the buildings on the far side of the road overshadow the ground floor facade, blocking solar gain.

“The solution was to raise the shop floor ceiling height to a storey and a half and install full height glazing, so that even on the winter solstice, solar gain penetrates the store,” McNally says.

Being in a terrace there was little scope for glazing on the east and west gable walls, so roof windows were installed in the single storey projection to the back to bring in more natural light.

Perhaps not surprisingly on such a complex project, the biggest challenge was airtightness. During the installation of precast concrete slabs at second floor level, connecting airtightness membranes were ruptured. Because the ▶

concrete hollow core slab-edge was compromised, penetrations (such as for services and stair opes) within the floor had to be sealed individually, whereas had the membrane been protected at the edge, this may not have been necessary. Extensive remedial work was required to get down to the passive house airtightness standard.

But McNally praises his contractor's persistence to get the result down to the passive house requirement of 0.6 air changes per hour. "He was never going to give up."

Contractor Barry O'Gorman says this was the most energy efficient and airtight building he has ever worked on. While he had experience of building down to around one air change per hour before, 0.6 was a different kettle of fish.

"It was a whole new challenge," he says, adding that in practice the difference between these two figures — which seem so close together — is "massive, it's unbelievable".

Even if the team hadn't been aiming for passive house, the nature of the site would have still made it a rather unique job. "Every day was a challenge in there," O'Gorman said. "I don't think you'd come across anything as complicated again."

Building a shop posed other issues too. The team were already on site when McNally realised the lighting design wasn't going to offer sufficient illumination in the shop area. "Lighting for retail is quite a specific skill," he says.

He brought in lighting experts Domus Projects to advise. "They came up with a scheme that allowed us to get very high levels of illumination with very low levels of energy."

Quirke was also keen to have automatically opening doors for the pharmacy, so that customers in wheelchairs — or with buggies — could get in easily. Custom-made triple-glazed automatic doors from Irish Door Systems were specified.

But in a busy shop where the doors are opening constantly, the heat loss here could have threatened the team's passive house ambitions.

Working with passive house consultants MosArt, the door losses were quantified and modelled. While increasing insulation might have offset the annual load, it wouldn't have addressed instantaneous heat losses.

So to be safe, McNally specified a hot air blower inside the shop above the door. The unit draws on heat supplied by the shop's gas boiler, and warms cool air that enters through the doors. This system has not been called into action during the first heating season, but will cover future extreme events.

The small thermostatically controlled condensing gas boiler also delivers heat to a single radiator in the shop. Quirke opted to put a new two-storey apartment in the space above the pharmacy, and though it isn't occupied yet, it's heated by a Nilan Compact combined heat recovery ventilation and air-to-air heat pump system, which also provides domestic hot water. Hot water produced by Kingspan Thermomax solar thermal collectors is integrated into the system.

Meanwhile the pharmacy is ventilated by a Paul Novus 300 MVHR system. The automatic

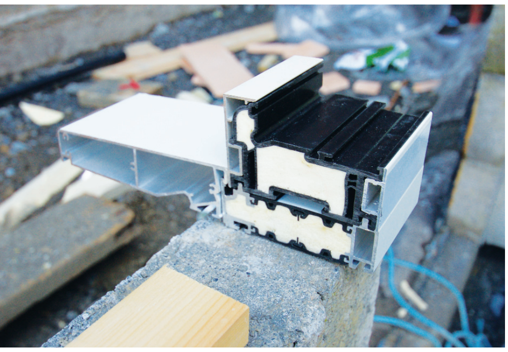
doors were kept open until November last year too, throwing some natural ventilation into the mix too.

The project came in on budget, and the pharmacy opened a month ahead of schedule. McNally is now undertaking post occupancy analysis, with data loggers measuring temperature and humidity inside. Up until Christmas, temperatures in the pharmacy were around 20 to 21C, with no heating on at all. He says the additional heat gains from retail lighting, computers, CCTV and other electrical equipment in the pharmacy are providing the majority of heat load. January and February saw Quirke using one hour of radiator heat each morning.

Passive house certification has just been achieved. McNally says the only theoretical stumbling block was the relatively higher primary energy demand of the pharmacy, but the lower demand of the apartment and concessions for retail energy use made it possible.

The only teething issues to date have been ▶

(below, clockwise from bottom left) a look inside the extra wide 250mm wall cavities prior to insulation; Foamglas Perinsul structural insulation on a pile cap; insulated cavity closers provide an efficient solution to closing the cavity at window and door reveals; the ground floor features 150mm of Xtratherm PIR insulation board under the slab; (p55) (top, l-r) Munster Joinery Alu-P window cill detail; Fakro roof windows were installed to bring in more natural light; windows installed on spacers and gaps filled with insulation; (bottom) street view of the original building which was over 200 years old and in a bad state of repair



"Every tradesman who turned up wanted to learn something about passive house"

with the triple-glazed electronic doors. "There were tweaking issues. But if that was the only major problem we had, then we haven't really had a problem to be honest with you," Quirke says.

The building is warm, comfortable, spacious, energy efficient, properly ventilated — everything you would expect from a passive house. As Quirke says: "It would have been futile to do this exercise and not get those things."

He observes that, for the tradesmen turning up on site during the build — carpenters, electricians, block layers and so on — the project was almost like a training course. "Every tradesman who turned up wanted to learn something about passive house," he says. "Everyone was doing something they hadn't done before."

"I just think it's a really great thing, that everybody has got something out of this," he says."I've got a great building…and the builders got something out of it, and all the subcontractors down the line got something out of it."

SELECTED PROJECT DETAILS

Client: Ronan Quirke
Architect: The PassivHaus Architecture Company
Main contractor: O'Gorman Construction
M&E engineer: Overy & Associates
Civil & structural engineer: Tanner Structural Designs
Quantity surveyors: Duffy Quigley
Mechanical contractor: Tierney Mechanical Services
Electrical contractor: Clantech
Airtightness tester: 2eva.ie
Bonded bead insulation: Dungarvan Insulation
Wall ties: Ancon
Thermal breaks: Foamglas
Mineral wool insulation: Isover
Airtightness products & wood fibre board: Ecological Building Systems
Floor insulation: Xtratherm
Airtightness products: Ecological Building Systems
Windows & doors: Munster Joinery
Roof windows: Fakro
Curtain walling: PJ Bowes
Brise soleil: QEF
Automatic entrance doors: Irish Door Systems
Green cement: Ecocem
Integrated heat pump/MVHR system: Nilan Ireland
Gas boiler: RVR
MVHR: Ollie McPhillips Building Energy Services
Pharmacy Lighting: Domus Projects
Cavity closers: SIG Insulation
Renders: K-Rend

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PROJECT OVERVIEW:

Building type: Treated floor area Pharmacy 111 sqm, Treated floor area Apartment 117 sqm, Duplex apartment over Pharmacy. Mid-terrace building of masonry wall with steel frame construction.

Location: O'Connell Street, Clonmel, Co Tipperary

Completion date: August 2014

Passive house certification: certified

Energy targets (respectively for pharmacy & apartment)
Space heating demand (PHPP): 12/15 kWh/m^2/yr

Heat load (PHPP): 11/11/W/m^2
Primary energy demand (PHPP): 163/89 kWh/m^{2}yr

Airtightness: 0.6/0.6 ACH at 50 Pa

Energy performance coefficient (EPC): 0.41/0.29

Carbon performance coefficient (CPC): 0.42/0.31

BER: A3 (380.86 kWh/m^2/yr) /A2 (46.75 kWh/m^2/yr)

Thermal bridging: first course of Quinn Lite blocks, low thermal conductivity cavity wall ties, thermally broken window frames, insulated reveals, FoamGlass beneath steel structure, SIG proprietary cavity closers, Vertical Quinn Lite course at curtain wall jamb.
Y-value (based on ACDs and numerical simulations): 0.08 W/mK

Ground floor: 150mm Xtratherm insulation under floor slab. U-value: 0.14

Walls: K-Rend render on 100mm blockwork. 250mm graphite enhanced EPS bonded bead, concrete block 100mm, Airtite plaster. U-value: 0.124

Roof: Tegral Rivendale slate, tiling batten on 40mm counter battens, Solitex Plus membrane, with all joints taped and sealed with Proclima Tescon Vana tape, 30mm Gutex Ultratherm wood fibre insulation on marine plywood 125mm timber cross members on 225mm rafters, full fill 350mm non combustible Isover Metac mineral wool insulation. Intello plus membrane vapour control layer, 100mm service void of 2 layers of 50mm each batten and cross batten FSC softwood filled with full fill Metac 100mm mineral wool insulation. U-value: 0.097

Windows: Munster Joinery Alu-P passive house certified aluminium window. Overall U-value: 0.8 Batimet TM50 SE Passive House Institute certified Curtain walling. Ucw installed 0.85

Heating system
Pharmacy: Victrix X 12kW condensing gas boiler, heating one radiator and one air curtain. Apartment: Thermomax tube solar hot water panel preheating Nilan compact P unit, which provides heating, DHW and heat recovery ventilation.

Ventilation
Pharmacy: Paul Novus 300 F 84% efficiency Passive House Institute certified.
Apartment: Nilan compact P unit, as described above.

Green materials: all timber fittings from FSC certified sources, 50% GGBS cement

EU president sets passive precedent

Motivated by the experience of building and living in a passive house, one of Ireland's leading political figures has become a public advocate for the standard. Passive House Plus visited the house to find out why.

Words: Lenny Antonelli

Former president of the European Parliament Pat Cox has perhaps become Ireland's most high profile ambassador for the passive house standard over the last few years. The former MEP and TD moved into his own passive house in Blackrock, Co Dublin last year, and his experience of the design and construction process — and of living in the house — has driven him to become an advocate for the low energy standard.

After moving back to Dublin from Cork, where he had lived during his time as an MEP, Cox and his wife Cathy wanted to upgrade their semi-detached home. They hired an architect and received planning permission for a partial upgrade and rebuild of the house.

They sat on the plans for a few years, then went out to tender for a contractor. One of the bids that came back was from Michael Bennett & Sons, the builder and developer behind the Isover Energy Efficiency Award-winning Grange

Lough passive house scheme in Rosslare, Co Wexford. Michael Bennett introduced the idea of passive house to the couple. “I had a very open mind to it. It was a term that I’d heard but I didn’t really know what it was,” Pat Cox says.

Bennett brought them to see the Rosslare project, and to visit Tomás O’Leary’s passive house in Wicklow, which was the first passive house built in Ireland, back in 2005. Cox says: “And then we decided okay, in principle, let’s go for it.”

But aiming for passive house was a leap of faith and a test of patience, because it meant designing a new dwelling from scratch, going back for planning permission, and demolishing the existing house — all of which was going to delay the build by a further six months. Tomás O’Leary’s architectural practice MosArt was charged with designing the new home.

Michael Bennett says: “We asked Pat to do something very big, and at times now I shiver a bit. We asked him to redesign his house completely and go back through planning.” Work began on site in July 2013, led by foreman Willie Burke. Knocking one half of two semi-detached homes obviously demanded the total trust and faith of the neighbours.

“I was thinking, I’ve never done this before with anybody — how’s it going to work?” says project architect Art McCormack of MosArt. “But it worked, because [Bennetts] knew how to do it technically, but also because of the rigour and the procedure on site.”

The unusual nature of the site meant that, once the old house was demolished, the next item on the to-do list was the landscaping. The back garden slopes steeply down to Dublin Bay, and there is no access from the back, so the team was able to use the time between the demolition of one house and the construction of the next to bring landscaping equipment in through the front.

For Art McCormack, who is both an architect and a landscape architect, the project presented a unique opportunity to design a house and garden together. The challenge, he says, was “to make sure that both were of equal quality”.

The back garden now consists of a winding path that descends steeply through a series of a planted terraces to a small gazebo overlooking the bay, making the most of a fairly small space.

With the garden finished, the timber frame — built by Wexford-based Shoalwater Timber Frame — arrived on site in October 2013, and the structure was up and weather-proofed by Christmas. The Coxes moved in during April 2014. “So it was an extremely efficient build,” Pat Cox says.

The timber frame is insulated with cellulose, plus glass wool in the service cavities. The pitched roof has an additional 80mm of wood fibre insulation over the rafters too, while the flat roofed terrace is insulated completely with glass wool.

The windows are Munster Joinery Passiv uPVC units, certified by the Passive House Institute, and manufactured at Munster’s plant at Ballydesmond, Co Cork. Bennetts also used these windows on the Grange Lough project in Rosslare. “We’ve got very comfortable with the product, ▶

we know what to expect, we know it's going to perform," Michael Bennett says. Meanwhile, Pro Clima Intello intelligent vapour barriers, supplied by Ecological Building Systems, form the airtight layer for the walls and roof.

Engineer Niall Crosson of Ecological says that when he first visited the site, he was skeptical about whether the house could get over the passive house target of 0.6 air changes per hour, because of how complex the building is, and the sheer number of junctions.

"The form of this construction is actually quite complex," he says. Crosson credits the workmanship and teamwork on site, and the quality of the materials, with the fact the building easily met the passive house airtightness target. "I just thought it was phenomenal given the complexity," he says.

One way Bennetts helped to ensure airtightness was by putting up a noticeboard on site — any time someone put a hole in the airtight layer, they had to record it for the whole team to see. "If anything happened – either deliberate or otherwise – it was acknowledged and dealt with," Michael Bennett says.

As usual with a passive house, good communication was key to the project's success. The whole team met on site with the clients once every two weeks. MosArt architectural technician Jill Noctor kept minutes of the meetings, and held everyone to account. "We left as clients with a lot of homework to do every time we had a meeting, because there were always choices," Pat Cox says. "That intensity of contact pays back as well, because there's a constant open communication flowing all the time."

Michael Bennett adds: "I think that's the secret. One of the rules that we have, and we stick rigidly by it, is every two weeks we have a meeting. We look to have the owner, or whoever is going to live in the house, with us all the way."

He adds: "We walk away when we're finished, and these are the people who have to live in it."

Cox was most impressed by the huge attention to detail paid by everyone on site — it reminded him of hi-tech manufacturing facilities he visited during his time as a politician. "The only place where I've seen quality control of this sort is in world class manufacturing plant," Cox says. "When I saw that here, it reminded me of visits I made to really world class plants. It was I guess, in some ways, the last thing I was expecting with someone doing a construction job on a site."

The house comfortably passed its airtightness test on the first go, coming in under 0.3 air changes per hour, though it ended up at 0.4 after further work on site. The Shoalwater team, led by Donal Mullins, was confident it would hit the mark, as they had been conducting their own airtightness tests all along.

Cox says the detailed attention to airtightness paid off in other areas too. "It's interesting that the quality spillover isn't just about getting the airtightness. People are so into quality, that they're getting everything right first time up, which is a fantastic experience if you're on the customer side of the equation," he says.

The house is heated very simply, by a Greenstar condensing gas boiler delivering hot water to two radiators — one in the hall and one in the sitting room. Meanwhile solar vacuum tubes on the south-facing front roof provide a good chunk of the hot water demand.

When Passive House Plus spoke to Cox in November of 2014, he had only turned the boiler on once to check it was working — but he had to turn it off when the house got too hot. There's also a Dantherm mechanical heat recovery ventilation system, certified by the Passive House Institute.

"I was pleasantly surprised how quickly we were living in the house. When you saw a hole in ground in October, and that you're actually living in a fully completed passive house in April, it is a seriously good turnaround," Cox says.

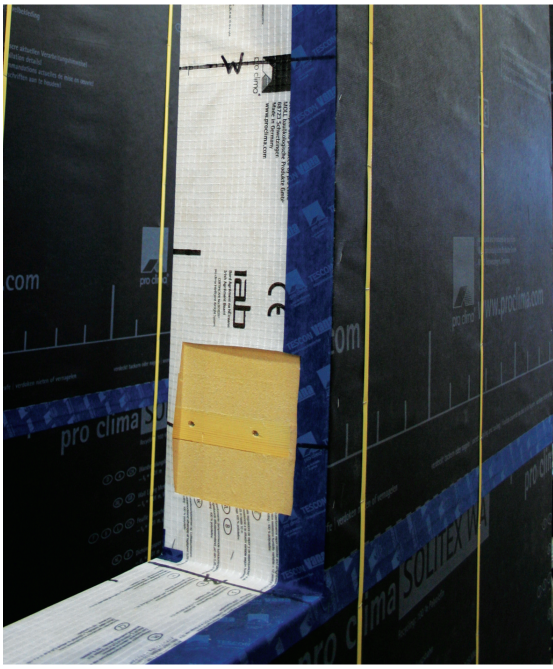
"Our strong feeling at the end of it is that we're the beneficiaries of the delays. What we've got is such a comfortable house to live in. We're sat with doors everywhere open and there are no draughts."

Perhaps not surprisingly, Cox has become a public supporter of the passive house standard over the last couple years. He even addressed the International Passive House Conference in Aachen, Germany last year. And speaking later in the year at See The Light, the Passive House Association of Ireland's annual conference, he called on Ireland to make passive house a national building standard.

"The time has come in Ireland for passive house standards to move from the margins to the mainstream, for building policy and its energy efficiency to become more active by becoming more passive," he said.

He elaborated on this by saying the passive house standard should be recognised as an alternative means of complying with Part L of the Irish building regulations.

He continued: "Ireland has the necessary design ▶



and construction skills to succeed. I know, having walked the walk and moved into a passive house last April. I know the attention to detail, the quality of the process from concept to delivery and the third party independent validation procedures as to standards that are an intrinsic part of the construction process."

"My call today is for Ireland to get more active on climate change by becoming more passive in building standards. Is anyone listening? Will an Irish city or county or the state finally see what so many others elsewhere can see and appreciate."

He elaborated on this when Passive House Plus visited his house in November. He said that what struck him at the International Passive House Conference in Germany was the sheer number of small and medium sized enterprises exhibiting. "It has spawned a whole industrial base," he says — and it could do the same for Ireland.

He adds: "Whichever English speaking state gives itself first mover advantage in [passive house], I actually think it will become a go-to place. And the amount of spin-off to do with small and medium enterprise, could be really, really large."

(p59, clockwise from top left) cellulose insulation is pumped into the timber frame walls; and the holes are then sealed with Pro Clima airtightness tapes; an airtight box for electrics; the metal web Posi Joists under the flat roof terrace were insulated with cellulose; Gutex wood fibre insulation boards used at window heads and jambs; wind-tightness detailing around windows and the insulated window cills

SELECTED PROJECT DETAILS

Clients: Pat & Cathy Cox
Architect: MosArt
Contractor: Michael Bennett & Sons
Timber frame: Shoalwater Timber Frame
Certification: The Passive House Institute
Airtightness tester: Greenbuild
Heating contractor: Harry Ryan
Electrical contractor: Doyle Brothers Electrical
MVHR installer: Dolmen Systems
MVHR: Dantherm, via Beam Vacuum & Ventilation
Windows & doors: Munster Joinery
Mineral wool insulation: Climowool, via U-value Insulations
PIR insulation: Kingspan
Airtightness products: Ecological Building Systems
Render: K Rend
Roof windows (Velux): Chadwicks
Roof lights: Ruhm Ltd
Condensing boiler: Greenstar
Gas fire: The Gas Company
Solar array & tank: Joule
Rainwater harvesting: Gemgate

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PROJECT OVERVIEW:

Building type: Semi-detached 242 square metre timber-frame dwelling on the site of existing house, which was demolished. The dwelling comprises two-storeys plus (dormer) attic with the ridge level to match previous dwelling.

Location: Blackrock, Co Dublin

Completion date: April 2014

Passive house certification: certified

Space heating demand (PHPP): 12.71 $kWh/m^2/yr$

Heat load (PHPP): 11 W/m^2

Primary energy demand (PHPP): 92 $kWh/m^2/yr$

Airtightness: 0.40 ACH at 50 Pa

Thermal bridging: details were designed as thermal bridge free, so no Therm calcs were carried out for this project. In PHPP an average of 0.01 W/mK thermal bridge is what Mosart estimate.

Ground floor: 150 mm concrete slab with 200 mm Kingspan Thermafloor TF70 PIR insulation. U-value: 0.121

Walls (timber frame, from inside): 12.5 mm plasterboard; 90 x 35 mm service cavity with Climowool fibreglass insulation; Pro Clima Intello airtight membrane between the service cavity and the timber stud wall; 220 x 44 mm timber studs with blown cellulose (Daemstadt) sealed with OSB, 50mm cavity, 100mm blockwork with K-Rend render externally, with 80mm Gutex wood fibre insulation boards used at window heads and jambs. U-value: 0.13

Sloped roof (from inside): 12.5 mm plasterboard; 50mm service cavity with Climowool fibreglass insulation; Pro Clima Intello membrane between the service cavity and the timber structure; blown cellulose in between the timber rafters (225 x 44 mm); 9mm OSB, Pro Clima Solitex Plus breathable roof membrane, timber battens, counter battens & concrete roof tiles. U-value: 0.153

Sloped roof (insulation on the flat ceiling): timber frame joists on the flat roof comprising (from inside): 12.5 mm plasterboard; 50mm service cavity with Climowool fibreglass insulation; Pro Clima Intello membrane between the service cavity and the timber structure; glasswool insulation in between the 150 mm joists; & 300mm glasswool above ceiling joists at staggered junctions. U-value: 0.087

Flat roof terrace: timber Posi-Joists on the flat roof comprising (from inside): 12.5mm plasterboard; 50mm service cavity; Pro Clima Intello membrane between the service cavity and the timber structure; Daemstadt blown cellulose insulation in between the 220 mm Posi-Joists, OSB timber deck with 100mm Kingspan PIR insulation and flat roof membrane laid to fall all to manufacturers design. U-value: 0.101

Windows: Munster Joinery PassiV Future Proof PVC windows with Super Spacer TriSeal PU. Passive House Institute certified advanced component. Overall U-value: 0.78 to 0.8.

Roof light: Ruhm bespoke roof light with triple-glazing, warm edge spacer, argon gas fill and internally fixed for security. Overall U-value: 0.7

Roof window: Velux triple-glazed GGL 6265 Passive House Institute certified roof window. Overall U-value: 0.75

Heating system: Highly efficient Greenstar 12 Ri condensing natural gas boiler and Faber Fyn 600 room sealed gas fire with balanced twin flue system to back up the space and water heating, plus Acapella solar vacuum tubes supplying 300 litre domestic hot water tank.

Ventilation: Dantherm HCH 8 heat recovery ventilation system. Passive House Institute certified to have heat recovery rate of 83%.

Electricity: A-Rated domestic appliances installed. Low energy bulbs throughout.

Green materials: recycled slate, cellulose insulation, clay based paint, all timber furniture from PEFC certified sources, vacuum tube collectors, rainwater harvesting.

SMART DUBLIN PASSIVE HOUSE

SHOWS TINY HEATING BILLS

Building this stylish south Dublin passive house, which recently picked up a Made in Germany energy efficiency award, demanded a steep learning curve, not least when it came to airtightness — but despite the struggles, it ultimately gave its owners their dream low energy home.

Words: Des Crabbe, architectural technologist, OA Studios

I had the fortune of meeting my clients Niall and Monica Walsh through another low energy house that I was working on. They had a sketch floor plan produced by an architect and asked me to build their passive-certified dream home. The motivation to build to the passive standard came from the clients. It was based not just on environmental responsibility and the desire for an excellent indoor climate, but a wish to implement the highest standards of workmanship and detail.

The passive house standard was a completely new concept to me, so it was my responsibility to get trained up on the theory as fast as possible. My steep learning curve continued through the construction stage as I project managed the build using direct labour. The planning authority, Dún Laoghaire-Rathdown County Council, has a large emphasis on energy efficiency in buildings and minimising carbon emissions, and preferred existing building stock to be

renovated rather than demolished and redeveloped. But we were able to demonstrate that the proposed new build would be vastly superior in terms of primary energy use and carbon dioxide emissions when compared to a renovation of the existing property.

We calculated the life cycle carbon dioxide emissions for the proposed new build and compared it with a theoretical low energy retrofit, taking into account both embodied and operational energy. While the embodied emissions of the retrofit were naturally lower than the new build, when we added CO_2 emissions from energy consumption over a thirty-year period our analysis showed the retrofitted home producing 225 tonnes of CO_2 in total, and the new build 130 tonnes. In the end, we built the new house to an even higher energy spec than in this analysis.

The other challenge we faced with planning was trying to build a modern contemporary house but keep within the form and style of the adjacent dwellings on Wilson Road. To this end, we decided to reuse the existing roof tiles from the demolished house, which would help the new property integrate into its surroundings. I recycled a lot of the old house, and my clients were committed to using sustainable and natural materials.

We decided to build with timber frame, and appointed Advanced Timbercraft to fabricate the structure. This was their first passive house too, so we all learned together, from the initial architectural construction details on the drawings that I produced right through to the erection of the frame onsite. The wall configuration is quite unique, with an open diffusion wall. We placed 80mm of Gutex woodfibre board directly onto a 240mm vertical I-beam structure externally and pumped the cavity with cellulose. We rendered externally using a breathable Stucco finish installed by specialists DB Plaster.

Meanwhile, I had passive house consultancy Passivate help me through the performance calculations in PHPP to establish exactly what we needed to achieve in the walls and roof in terms of U-values. The passive house community in Ireland is still small but growing rapidly. I was able to bring the best tradesmen and consultants onto the project to help deliver this unique home, and I would have not achieved it without them.

This house, being of a unique design and ▶

Photos: Ian F T Young

construction, introduced a lot of challenges. My groundworks contractor Halton Construction bravely took on the task of fitting the Swedish-designed Supergrund foundation system. This insulated raft system with external wall ring beam support structure was like no system we had ever worked on before. I had to keep emphasising the need for the set out of the system to be absolutely perfect on level and position of ring beams, as the timber frame was being fabricated to suit while we were installing the Supergrund. I also did not want a reduction in the treated floor area, which would affect my overall energy performance. In the end, Halton delivered a perfect job and the timber frame fitted the foundations down to the millimetre.

The most difficult challenge I faced on the project was airtightness. We placed a Pro Clima Intello airtight membrane on the inside of the roof structure throughout, and decided not to use a floor screed as there would be no underfloor heating. We achieved 0.9 ACH on our first blower door test and found it incredibly difficult to get better results. We found that the OSB3 was leaking and decided to cover it with a Pro Clima DA membrane, which brought us down into 0.7 territory.

We realised that maybe more care should have been taken in protecting the Intello membrane during construction as there were tiny nail holes all over it at eaves level, and these were difficult to reach. In the end we ran a blower door fan continuously and used a thermographic camera and smoke guns to identify the leaks. My entire team — including the supplier Ecological Building Systems, Passivate, DB Plaster and Advanced Timbercraft — worked together to help me solve all the airtightness problems and I was delighted when our airtightness tester, Gavin O Sé of Greenbuild, told us we had met our goal and achieved 0.53 air changes per hour at 50 Pascals. In credit to my clients, they were willing to allow the project to go on hold for three to four weeks until we resolved the underlining problems. This allowed us to move on quickly then and complete the project.

I have learned so much from this first passive house project. Building a passive house has not only developed my business rapidly, it has taught me how to design and deliver buildings to the absolute highest standard. I have had the pleasure of staying in this house recently, and the indoor environment was like nothing I have ever experienced. My clients said after moving into and living in a passive house, they would never build to a lower standard again. In my experience a lot of clients will base their decision about whether to build passive solely on money, which is understandable in the current economic climate. But achieving passive house is getting cheaper every day as innovative professionals find smarter and better construction methods. I have built three more passive houses now, and I explain to all my clients that the benefits are not in just the tiny heating costs, but in the comfort, and in creating a healthy environment for your children.

It's likely the largest capital expenditure of your life will be your home. If you build a certified passive house, at least you know the house has been built right and rigorously checked, giving you the best value for money. I hope to build my own house soon and I would not consider any lower standard.

'Passive house is the only way to live'

Words: Monica Walsh, homeowner

Living in a passive house has to be experienced to be understood. It is hard to comprehend that the whole house — and I mean every part, item and surface — is warm. On recent open days I gave a simple demonstration to show how every surface in the house is at 20 to 22C. I took out a plate from the press and gave it to some visitors to touch — they were amazed, it was warm. I gave a jar of sauce to someone else, same response. I invited people ▶

(top) the Supergrund insulated raft foundation system; (above) Thermo-Hemp insulation installed in the pitched roof; (below) installation of the Fakro rooflights with Intello membrane; (right) rear of the house showing the Gutex Thermowall external insulation; (p67, bottom left) heating, lighting, ventilation and rainwater harvesting are all monitored and managed through the KNX intelligent building home automation system

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"Living in a passive house has to be experienced to be understood."

to touch our travertine floors and again they were warm.

The mechanical heat recovery ventilation is another big factor in the overall atmosphere in the house — we have fresh warm air even when it's 2C outside. And as for costs of utilities, using the KNX intelligent home automation and energy management system in the house, I know that we are spending less than €200 a year on hot water and supplementary heating. So far this winter we have had the backup heating on for about eight hours in December and ten to twelve hours in January.

The KNX system also controls all the lights and the rainwater harvesting system. The majority of the lights are LED and when switched on, they only come on at 30% daylighting, though we can also adjust the brightness with the wall switches or a smartphone. In conclusion, I have become very passionate about passive housing and I actually get angry when I see new builds that aren't to the passive house standard. I just wonder if the client or architect or builder has heard of passive houses and understands the benefits to their pocket, health and the environment.

The environment in our house is fantastic. It's warm but not stuffy in the winter, and cool and fresh in the summer. The air is fresh, there are no drafts, no cold spots, no damp patches, no condensation on the windows, no gas bills, no oil bills, no noise due to the insulation. It's the only way to live.

SELECTED PROJECT DETAILS

Clients: Niall & Monica Walsh
Architectural & project management: OA Studios
Timber frame: Advanced Timbercraft
Main contractor: Halton Construction
Civil & structural engineering: Fahy Fitzpatrick Consulting Engineers
Airtightness & insulation products: Ecological Building Systems
Airtightness tester: Greenbuild
Windows & doors: Internorm
Mechanical contractor: Ollie McPhillips Ltd
Heat pump & solar: Daikin, via Pure Renewable Energy
MVHR: Paul, via Pure Renewable Energy
Insulated foundations: Kingspan Aerobord
Energy consultant: Passivate
Lighting: Lights4Living
Heating & lighting controls: IDAS
Rainwater harvesting: Graf, via Watersource
Roof lights: Tradecraft Building Products
Electrical contractor: JR Healy Electrical

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PROJECT OVERVIEW:

Building type: 256 sq m single-storey bungalow styled dwelling to the front south elevation with pitched A-roof. Two-storey contemporary styled dwelling to the rear north elevation with flat roof sections.

Location: Mount Merrion, Co Dublin

Completion date: November 2011

Passive house certification: Certified

Space heating demand (PHPP): 11 kWh/m^2/year

Heat load (PHPP): 7 W/m^2

Airtightness (at 50 Pascals): 0.53 ACH

BER: Not available

Utility bills: Total utility bill for 2013 was circa €2000. Of this approximately €170 was for the heat pump (space heating + hot water) and the rest was for electrical appliances.

Ground floor: 500mm high Kingspan Aerobord Supergrund 'F' external wall profile (ringbeam). Internal retaining walls formed with Q7 Quinnlite blocks. Build-up: 100mm slab with reinforcing mesh, on 400mm EPS100 insulation, on 50mm stone blinding (3-8mm stone), on Monarflex Radon DPM barrier c/w sump and vent pipes by Neoflex, on 250mm compacted hardcore. U-value: 0.075

Walls: 80mm Gutex Thermowall external insulation with Stucco render, on 241mm lightweight I-beam Advanced Timbercraft timber frame structure with Daemstatt cellulose insulation, 18mm OSB sheeting, Pro Clima DA Membrane taped and sealed with Pro Clima airtightness tapes glues, and accessories, 89mm service cavity with hemp insulation and 12.5mm Gypsum plasterboard internally. U-value: 0.093

Pitched roofs: Re-used existing tiles externally on 50x25mm soft wood treated timber battens at 250c/c, on counter battens, on Solitex breathable high performance felt, on 70mm foil backed PUR insulation, fixed to 175x44mm rafters at 400c/c with pumped cellulose insulation, on Pro Clima Intello membrane, on 89mm service void with hemp insulation between, on 12.5mm Gypsum plasterboard. U-value: 0.122

Flat roofs: Standing seam Alkor membrane externally, on 18mm WBP plywood, on firring pieces all to achieve 1:80 fall to gutter valley, on battens, on Solitex breathable membrane, on 70mm foil backed PUR insulation, on 175x44mm rafters at 400c/c with pumped cellulose insulation, on Pro Clima Intello membrane, on 50mm battens to form service void with hemp insulation, on 12.5mm Gypsum plasterboard. U-value of 0.128

Windows: Passive House Institute certified Internorm triple-glazed alu-clad windows with a thermally broken painted spruce timber frame. Argon-filled cavities with low emissivity glass. Overall U-value: 0.71

Rooflights: 7 triple-glazed Fakro FTT U6 Thermo rooflights with class four airtightness level, warm TGI spacers, Krypton-filled cavities. Overall U-value: 0.81

Heating system: Daikin Altherma 11kW air-to-water split heat pump & two Daikin solar collectors each with 300L hot water storage tank & 3kW back-up immersion element. Heat distribution: four 1kW towel radiators in bathroom & en-suites plus radiator at north on each floor. All integrated & programmable via KNX energy management system.

Ventilation: Paul Novus 300 Passive House Institute certified heat recovery ventilation system of minimum 90% efficiency, interfaced through KNX control LCD panels.

Green credentials: woodfibre, cellulose and hemp insulation. 4800L Graf Carat rainwater harvesting tank with multiple filter packages allowing rainwater to be used throughout the house including for drinking and showers. KNX intelligent building home automation and energy management system delivering energy savings of 60% throughout the home with light, ventilation, shading and heating. Low voltage LED lights throughout house with dimmer control and motion sensors integrated into the KNX control / interface.

UK's 1st Enerphit, six years on

Six years after it was completed, Passive House Plus takes a look at a pioneering low energy upgrade that went on to become the UK's first certified Enerphit project, to find out how it has performed — and what lessons have been learned.

Words: Lenny Antonelli

Photos: Christopher Kenworthy

At Passive House Plus we write about some of the most energy efficient buildings in the world, and our writers often complain about the frustration of reporting on ultra-comfortable buildings while not having the luxury of living or working in one. Equally most passive house architects we meet don't live or work in super low energy buildings, so they might share our frustration.

One architect who does live in a passive house is Andy Simmonds of Simmonds Mills, one of the UK's leading passive house practices. He lives at Grove cottage, a detached house in Hereford originally built in 1869, but the subject of a deep energy retrofit in 2008. The aim was to bring the house as close-as-possible to the passive house standard, and the dwelling was later certified as meeting the Passive House Institute's Enerphit standard for retrofit.

This makes Grove Cottage a valuable source of information for the passive house community. Not only is it an ultra low energy retrofit, it's one inhabited by a passive house architect who can report on the minutiae of its performance.

Grove Cottage is of solid brick construction, and though it's completely detached, one gable wall is a mere 25mm away from the next door neighbour's house. Not surprisingly given its age, the house was hard to heat and draughty, with uneven temperatures inside, despite its high energy bills.

In 2008, Simmonds set out to upgrade the 90 square metre cottage, and to build a 45 square metre extension to the rear. Planning restrictions on the extension, and the desire to add new south-facing glazing, meant the form of the upgraded dwelling would be quite complex — and more surface area means more heat loss. To offset this, onerous low U-values were required from each of the building elements.

Most of the existing brick walls were insulated externally with 250mm of EPS insulation, while insulated timber studwork (Larsen truss method) was used externally to insulate part of an old two-storey extension at the back. A new, single-storey kitchen extension was also built into the garden, comprising externally insulated blockwork on an insulated, reinforced concrete raft.

Meanwhile the gap between Grove Cottage and the neighbour's house was filled with polyurethane to provide airtightness, and to reduce heat loss and air movement between the buildings. Grove Cottage was completely re-roofed, with the airtightness and insulation layer placed over the rafters to create a habitable attic space.

The main axis of the house is east-west, but new high-level south-facing windows were built into the extension and the old part of the house to provide daylighting and winter solar gain. Naturally given its passive house ambitions, triple-glazing was installed throughout.

The basement was thermally isolated from the rest of the house. The airtight, vapour control membrane was installed under the joists, with wool insulation between and below the joists. And to turn the basement into a more useful (yet still unheated) space, a new DPM and concrete slab replaced the earthen floor.

Vapour control membranes form the airtight layer for high-level timber frame wall and roof elements, while an external cement parge coat provides this function around the masonry of the original house and the new kitchen extension. Careful detailing ensures these two systems connect up to form a continuous airtight layer. There's also mechanical ventilation with heat recovery, while space heating and hot water is supplied by a small natural gas boiler delivering

heat via some of the dwelling's original radiators.

Those are the basics of the upgrade: but how has the house performed since 2009, and what lessons have been learned?

Speaking to Simmonds now, his overall message about the house's performance is exactly what you might expect from a certified Enerphit project: conditions inside are highly consistent and comfortable. The only issues and "lessons learned" related to a relatively small number of details – mainly focused around the suspended ground floor over the basement, and related to the lack of a DPC and inadequate basement ventilation.

Simmonds says that despite the fluctuations in temperature between the relatively cold winters of 2010 and 2011, and the milder winters have followed, the house's gas consumption has been fairly consistent year-on-year, only changing slightly, and always staying under 7,000 kWh. In 2010, the total gas bill for the year at Grove Cottage was £384.45.

"It's surprisingly consistent how much gas we use," he says. During the same year, temperatures inside averaged 20.8C, with the maximum figure recorded being 24.5C in the upper hall, and the minimum being 18.5C in one bedroom which has two external walls and no radiator.

Relative humidity has remained steady, with an average figure in 2010 of 48.9%. The house has not experienced any overheating, except for some in the attic room, where there is "localised and slightly excessive solar gain" through east and west-facing roof windows during heatwaves. He plans to buy a simple external solar blind to combat this.

Simmonds says insulating externally kept the building's thermal mass within the insulated envelope, helping to smooth out internal temperatures. This also helps to keep the masonry warm and dry. During the heating season the gas boiler is set to a continuous heating regime with weather compensation, and only comes on when top-up heat is needed to maintain the house at the thermostat setting, delivering heat to the rads at a low temperature.

After the build, Simmonds installed moisture monitors in some of the ground floor timbers to monitor conditions here. Some wall plates in the basement and joist ends had rotted away from the damp masonry in the years before the retrofit, while ground floor timbers that were embedded in the old brick walls were suffering from ongoing decay.

During the retrofit some joist ends were cut back from the external walls and supported on beams spanning the basement. However Simmonds says that due to oversight, inexperience, and a desire to keep the floor structurally connected to the walls, some joists were left embedded in — or tight up against — the damp basement wells.

Simmonds says at the time, he wrongly considered the use of sheep wool – based on its capillary active characteristics – adequate to help safely move moisture from wetter areas at joist ends to drier areas where the moisture would be able to dissipate through the assembly.

Although more broadly the floor remains in good condition, with the moisture content of joists within acceptable levels, Simmonds believes the airtightness and insulation work in specific areas of the floor edge may have exacerbated the problem of localised timber decay, by reducing the removal of water vapour associated with bulk air movement at these points. Combined with a slight increase in temperature, he says, timber decay becomes more likely.

Simmonds ended up removing edge floorboards and cutting back a handful of rotting joist ends, which were already supported on the timber basement beams. He has also drilled preservative boron plugs into the joist ends adjacent to the chimney stacks, which were too difficult to remove. The two joists adjacent to the gable walls have been replaced with recycled plastic timber and the edge insulation and airtightness detail has been reinstalled and improved.

During this latter operation, a DPC (damp proof course) cream was injected (Dryzone from Safeguard Europe), which will help to reduce rising damp loads up into the house via the masonry walls. Simmonds has also improved cross ventilation in the basement by unblocking an air vent that became clogged with debris during the retrofit, and has also worked to reduce surface condensation on the basement walls. A second DPM recently placed over the concrete floor slab in the basement has prevented this being a condensation-fed moisture reservoir (leading to high humidity in the basement air).

Simmonds says the basement is now much drier and more useful — in winter it averages about 11C inside, with 60% relative humidity — and serves as a music room. "These measures mean that water vapour is now generally moving from the house through the floor into the basement and away via ventilation air to the outside, whereas before the opposite was generally occurring." he says.

Simmonds carried out all this work himself, and says it could have been avoided if he had had a better understanding of moisture mechanisms and pathways in these critical ground floor zones in 2008. He says the remedial work has prevented or at least significantly reduced the risk of ongoing rot at the floor edges — and reinstated the thermal and airtightness performance in a more robust manner. Meanwhile, the lessons learned have helped to inform Simmonds Mills' detailing for other retrofit projects and is informing the AECB retrofit course which he is involved in writing.

But back inside the thermal envelope, how is the main body of the house performing? Simmonds says a couple of spots in the house tend to be cooler. One is by the double external doors in the kitchen (leading to the garden), which have become a bit misaligned — perhaps due to heavy family use. This has led to some air infiltration, and requires attention from time to time to ensure frame and seals meet properly.

"The doors need annual readjustment to sit properly against their seals," he says. "You become extremely attuned to the lack of draughts in this sort of house — so you can identify the smallest draught very easily!"

Another similar spot is around the sitting room floor adjacent to the gable walls in the old part of the house, where — despite the rejigged floor-to-wall detail described above — there ▶

(above) most of the existing brick walls were insulated externally with 250mm of Permarock Platinum EPS insulation; (below left) part of the house also features a green roof with a variety of wildflowers; (opposite) (left) Knauf mineral wool to I-beams on main roof; (right, top) Foamglas Perinsul structural insulation helps cut out thermal bridging while (right, bottom) the new extension floor was insulated with 250mm of Jablite EPS under a reinforced concrete raft

remains an unavoidable thermal bridge. Simmonds says the temperature here is a bit cooler than elsewhere — and by cooler, he means about 19C. Many of these issues are subtle effects he has picked up on while trying to identify the impact of remaining thermal bridges on perceived comfort.

This reminds Passive House Plus of the late David Foster Wallace's essay 'Shipping Out', in which the author spends a week in the Caribbean on one of the world's most luxurious cruise ships. But when the ship docks and another — newer, shinier and even more luxurious — ship docks alongside it, the author starts to become irrationally unhappy with the tiniest details that aren't right about his own palatial boat. It seems to be human nature that the more comfortable our surroundings, the more we become attuned to the tiniest of things that are out of place.

Simmonds agrees: "It's an absolute illustration of human nature isn't it — everything's relative."

What advice would Simmonds have for anyone embarking on a similar retrofit? He recommends thinking well ahead of time, and taking steps to dry out the structure of a masonry building six months or more before upgrading, reducing rising damp loads and "turning off the rain" load by using rainscreen cladding, lime renders or brick creams. These rain shedding measures must continue to allow water vapour to diffuse outwards as this is a crucial drying mechanism.

Simmonds says this is important for masonry buildings, so that subsequent insulation — especially when insulating internally — and airtightness work does not have to deal with excessive moisture loads either immediately after retrofit, and on an ongoing basis thereafter.

"Anticipating moisture loads, and planning ahead to reduce and manage short and long term risks to the fabric and indoor air quality, is one of the most important technical challenges when retrofitting buildings," he says.

When asked what else he would have done differently, given six years of hindsight, the answers are all non-technical. He would like to have put the MVHR somewhere else, as despite being accessible, easy to maintain and close to the external wall — for short duct runs — he would like to have installed a window facing the garden in this area downstairs. He says the unit is quite a large prototype that takes up a lot of space. But he adds: "You can't get everything you want in a smallish urban plot."

His overall message? "This is the most comfortable building we've ever been in, compared to all our previous experiences," he says. "This house is incredibly thermally comfortable in all areas — all year, bright, sunny and calm, the air is consistently fresh and heating bills are extremely low. A joy to live in!"

SELECTED PROJECT DETAILS

Clients: Andy Simmonds & Lorna Pearcey
Architect: Simmonds Mills
Contractor: ECO-DC
Project management: Simmonds Mills
Energy consultant: David Oliver
M&E engineer: Alan Clarke
MVHR: Green Building Store
Structural engineer:
Bob Johnson Consulting Structural Engineers
Passive House certified: Passive House Institute
Finance: Ecology Building Society
Airtightness tester: ALDAS
External insulation (supply): Permarock
External insulation (install): EJ Horrocks
Additional wall insulation: Knauf
Pipe insulation: East Midlands Insulation
Thermal breaks: Pitsburgh Corning
Roof insulation: Knauf
Floor insulation (wool): Thermafleece
Floor insulation (EPS): Jablite
Floor insulation (PUR): Kingspan
Airtightness sealants & tapes: Green Building Store
Airtightness membranes: Ecological Building Systems
Windows & doors: Internorm
Roof windows: Fakro
Cladding: HW Morgan & Sons
Gas boiler: Valiant
MVHR ducting: Lindab
Water saving fittings: Wickes DIY
Carpets: Natural Carpet Company
Paints: Earthborn
Paints: Keim

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PROJECT OVERVIEW:

Building type: Retrofitted 90 sqm detached 1869 solid brick cottage, new 45 sqm blockwork & timber frame extension, & 40 sqm unheated basement.

Location: Hereford, Herefordshire, UK

Completion date: 2009

Budget: Approximately £140,000 (incl. £15,000 in discounted & sponsored materials)

EnerPHit certification: certified

Space heating demand
Before (SAP): 246 kWh/m²/yr
After (SAP): 14 kWh/m²/yr
After (predicted, PHPP): 25 kWh/m²/yr (to treated floor area of 135 sq & temperature 20C)
After (measured, gauged by removing estimated hot water & cooking gas consumption): 35 kWh/m²/yr (due to higher internal temps)

Heat load (predicted, PHPP): 13 W/m²

Primary energy demand
Before (measured, 2005): 284kWh/m²/yr
After (predicted, PHPP): 108 kWh/m²/yr
After (measured): 120 kWh/m²/yr (at higher temps, includes separate home office electricity use for heating & power)

Gas consumption
Measured used in 2005: 24,000 kWh/yr
After (measured, 2010): 6937 kWh/yr. Has remained under 7,000 kWh/yr each year since occupation.

Gas bills
Before (SAP calculation): £1,540
After (2010): £184.45

Airtightness (at 50 Pascals)
Before: Not measured (not measurable!)
After: 0.82 m³hr/m²

Thermal bridging
Prior to retrofit, the house had typical existing thermal bridges such as solid lintels, intermediate floors & corners. The house was essentially one big thermal bridge apart from the insulated attic & double-glazed front windows. External insulation eliminated most thermal bridges. Therm modelling used to address specific remaining areas (at wall to suspended ground floor junction over basement) & use of AECB CarbonLite details to guide design of new construction elements.

Existing ground floor
Before: Suspended timber floor over cellar: U-value: 0.75 Solid concrete floor to old extension: U-value: 0.85
After: Suspended timber floor on 175mm of Thermafleece insulation between joists, covered with 9mm OSB drilled with large holes for enhanced breathability. Intello intelligent vapour & airtight membrane stapled across underside of OSB, & sealed down to the walls. Additional 50mm of Thermafleece between 50 x 50mm softwood battens (at 90 degrees to joists above) spanning across underside of floor construction to reduce repeating thermal bridging of timber floor joists. U-value: 0.183
Existing concrete floor to old extension upgraded with 100mm Kingspan polyurethane foam board laid over liquid painted DPM on slab underneath. 2 layers of wbp plywood laid as floating floor deck. Covered with Intello membrane sealed to wall edges. Plywood flexible adhesive used to fix floor tile finish. U-value: 0.193

Existing walls
Before: Uninsulated solid brickwork walls. Gable wall brickwork facing neighbour's property, 25mm gap.
After: brickwork walls insulated externally with 250mm of Permarock Platinum EPS. Mechanical fixings to hold insulation in place, fixings recessed into insulation & covered with EPS to minimise thermal bridging. U-value: 0.115
Part of original two-storey extension insulated externally with timber-frame (Larsen truss) method, insulated with 350mm Knauf mineral wool, with 9.5mm OSB & breather membrane external to studwork. U-value: 0.093
Variable 25 – 40mm gap between dwellings injected with polyurethane foam to create an insulated party wall: 0.388

Roof (whole house)
Before: 150mm of loose fill cellulose to loft of original house. U-value: 0.67
After (existing house & extension): Slates externally on battens & counters, low vapour resistance sheathing membrane & 9.5mm OSB sheathing, new 400mm deep I-beams over rafters at 920 centres (twice existing rafter spacings) fully insulated with Knauf mineral wool screwed via bottom flanges through Monarflex vapour membrane & 20mm timber planking to connect I-beams, existing attic joists. U-value: 0.084

Green roof elements: Plasterboard & skim, followed above by 25mm service void, Monarflex membrane, 10mm OSB, 400mm I-beams & Knauf mineral wool, 10mm OSB sheathing, vapour permeable sheathing membrane, 100mm counterbattens, plywood deck, waterproof membrane, drainage layer & soil/wilderflowers. U-value: 0.085

Extension walls: Single leaf concrete block work (140mm block) with 250mm Permarock Platinum EPS at ground floor level, as per existing house. Partially rendered, partially timber clad . U-value: 0.123

Extension floor: 40mm compacted stone base underneath, followed above by 250mm Jablite EPS, DPM & 200mm reinforced concrete raft. U-value: 0.134

Windows
Before: uPVC double glazing to front of house. U-value: 2.7. Single glazing to rear. U-value: 4.8.
After: Triple-glazed Internorm Edition timber aluclad windows. Average overall U-value: 0.9
Triple-glazed Fakro roof windows. Overall U-value: 2.0

Door
Before: Solid timber front & back door, half-glazed extension door.
After: Fully triple-glazed & insulated Internorm Edition patio type doors. Average overall U-value: 0.9

Heating system
Before: 67% efficient gas boiler with radiators & a separate gas water heater in kitchen.
After: Valiant EcoTEC Plus 415 condensing gas boiler with weather compensation for space heating & domestic hot water. 90.5% efficient (SEDBUK), distributing to existing radiators.

Ventilation
Before: Natural ventilation via windows; two flues & two chimneys. High levels of air infiltration from basement via ground floor into living rooms.
After: Paul Thermos 200 MVHR. 90% heat recovery efficiency, 0.53 W/l/s specific fan power (SAP Appendix Q figures). Galvanised Lindab ductwork. Chimneys reduced below insulated roof line & incorporated within airtightness barrier zone.

Green materials: Low energy lighting throughout, green roofs to extension, natural paints, timber frame extension, FSC certified sawn sand timber composites including locally sourced western red cedar cladding from a local woodland & profiled by local sawmill. Reused timbers salvaged from roof (purlins) for structural use in new roofwork & to strengthen first floor areas under water tank & bath.

Fabric-first retrofit rejuvenates Dublin social housing

Photos: Donal Murphy

Built in the 1970s, Rochestown House was a cramped, cold and damp social housing block in Sallynoggin, Co Dublin that has now been completely transformed, thanks to a deep energy retrofit inspired by passive house principles.

Words: Jason Walsh

Can decades-old concrete flats be raised up to anything like the passive house standard? This was precisely the question faced by Dún Laoghaire-Rathdown County Council in Dublin when it came to retrofitting the Rochestown House complex in Sallynoggin.

A pair of low-density social housing blocks built in the 1970s — and catering primarily for the elderly — Rochestown House presented some of the archetypal challenges of social housing retrofit: the residents didn't want to move, but the properties failed to meet anything like adequate standards of airtightness or insulation, and needed a major overhaul.

A survey by consultant engineers Hanley Pepper got the process underway — and its findings were not good. It was discovered that there was insufficient ventilation and natural light in all ground floor units; while steel sections at balcony level were rusted and in need of repair.

Repair was also needed to various elements of the porches, window sills, and drainage, while re-tanking was recommended for the block's balcony level. Asbestos was also found on-site. All-in-all, not only was the building envelope insufficient, but there was potential for serious health issues.

Work on Block 2 began in April 2013, and was completed by December of that year. The second phase of the project — currently underway — will now aim to upgrade the larger Block 1 to Enerphit, the Passive House Institute's retrofit standard. But even though Block 2 didn't aim for Enerphit, it still applied fabric-first principles of generous and continuous insulation, airtightness, and proper ventilation.

Block 2 is a two-storey concrete block building with a pitched roof. Its cavity walls were completely uninsulated prior to renovation. The orientation of the block is north-northwest to south-southeast. All of the flats were dual aspect, however the ground floor units had their living accommodation to the north elevation. Also, due to the existing trees and vegetation on the site, solar gain is limited.

A building energy rating (BER) assessment by Michael Hanratty of IHER Energy Services revealed much room for improvement: out of five sample units over the two blocks, four were rated G and one was rated F.

The accommodation was also partly in conflict with rules on dwelling size: aside from the six upstairs one-bedroom apartments, Block 2 ▶

had 12 bedsit apartments, a form of dwelling outlawed under regulations that came into force in February 2013 after a two-year lead-in period, following legislation drafted by the Green Party, partners in Ireland's previous coalition government.

Dún Laoghaire-Rathdown County Council's architecture department undertook design of the refurbishment in-house, coming up with a series of proposals comprising general refurbishment, expansion of the bedsits, and a significant energy upgrade.

"Since the [recession-led] funding cuts we've not had the funds for new-build [but] we've always had a refurbishment programme," says Sarah Clifford, architect with Dún Laoghaire-Rathdown County Council.

The low, outdated standard of accommodation at Rochestown House made its renovation a priority— and offered lots of low-hanging fruit for energy upgrade. "Our aim wasn't [specifically] Enerphit but it was to do the best refit that we possibly could," Clifford says. "We really needed to upgrade the existing accommodation; it was very damp."

Nonetheless, it was with some trepidation that the initial survey was undertaken. "You're never 100 per cent sure what you're going to come across in a retrofit. You have to deal with whatever is there."

In the end, what they did come across was the need for serious remedial work. The bedsits in particular, at this point unoccupied, were a particular problem, suffering from major dampness and mould growth problems. "The ventilation was practically non-existent in them," Clifford says.

This is hardly unusual for building of the era, but it presented a particular problem given the requirement for much more insulation. Without due care to ventilation, key energy upgrade measures such as blocking up chimneys and making the building more airtight would have risked further promoting damp and mould growth. A demand-controlled mechanical extract ventilation system from Aereco was chosen to address this, combining central mechanical extract fans in each unit with humidity-sensitive wall vents in rooms, to ensure that ventilation rates reduce when rooms are unoccupied, thus preventing unnecessary heat loss.

Meanwhile the antiquated existing oil-fired district heating at Block 2 was removed, as were the individual hot water cylinders that took up valuable space in each unit. A new district heating system was installed, drawing from a Worcester Bosch condensing gas boiler. The new system foregoes storage tanks completely, ▶

instead relying on instantaneous heating. Rather than use packaged consumer units, bespoke systems were made on site, including plate heat exchangers for hot water and motorised valves for space heating. The plant room is external to Block 2, and relies on Logstor preinsulated pipework to reduce heat loss before entering the building. A combined heat and power system was considered but rejected due to the lack of communal space around the block.

Despite the problems with the flats, such as single-glazed windows and a total absence of insulation, residents were nervous at the prospect of change. "The residents were unsure of the work; they were worried about having to move out, but they're all happy now," Clifford says.

The 12 unoccupied bedsits on the ground floor are now six occupied one-bed apartments, with their internal layout reversed, thus providing a south facing elevation in living areas in order to enhance solar gain. There are a further six one-bed apartments upstairs.

Scale was also an issue with the job, but not an entirely negative one: "Quite often the reforms we've done before would have been done in [small] lots, broken into packages, whereas with this we were able to it as a [single] job with one contractor," Clifford says.

Kevin Enright, quantity surveyor at main contractor K&J Townmore Construction, downplays the difference between this job and any other, at least from the contractor's point of view: there was a job to be done; and it was done.

"It was much the same, straight-up," he says. "The spec was sent out and we had to work with that spec."

The question of scale, however, did come into play: "It would be, at that level, a new thing for us. We'd have done elements such as mechanical and electrical and so on, but there was never a whole approach before and airtightness was one of the bigger tasks done. It was a high detail job."

"I have no reservations [about working to the low energy specification]. I won't say it was an easy job, but it was doable to the specifications laid out," he says. ""The central thing was the external envelope."

The addition of external insulation was one of the main changes—after all, this was a housing block with no insulation whatsoever before. A Parex Lanko system comprising 100mm expanded polystyrene with a mineral render finish was applied externally, while the cavity walls were pumped with polystyrene bead, a combination which brings the walls into the realm of passive house specs, with a U-value of 0.17. Meanwhile, 300mm of mineral wool was installed in the attics, bringing the U-value down to 0.18.

Double-glazed alu-wood composite windows and doors with an overall U-value of 1.4 replaced the previous aluminium single glazing throughout the block. To prevent cold bridging, the windows were bracketed out from the blockwork, to form a continuous thermal layer with the external insulation.

The second phase of the project — retrofit of the main block at Rochestown House to the Enerphit standard — is expected to be completed by early 2016.

SELECTED PROJECT DETAILS
Client: Dún Laoghaire-Rathdown County Council
Architect: Dún Laoghaire-Rathdown County Council Architects' Department
Main contractor: K&J Townmore Construction
M&E engineering: Ramsay Cox & Associates
Mechanical contractor: Grade Mechanical
External insulation contactor: SF Plastering
Airtightness testing: Stroma Technology
Building energy rating: IHER Energy Services
Windows & doors: Aluwood
Ventilation: Aereco
External insulation system: Tradecraft Building Products Ltd
Airtightness products: Ecological Building Systems
Condensing boilers: Worcester Bosch

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PROJECT OVERVIEW:

Building type: 503 sq m two-storey sheltered housing scheme, originally 18 units (6 one-bed and 12 bedsits), post refurbishment 12 one-bed apartments

Location: Sallynoggin, Co Dublin

Completion date: December 2013

Budget: €761,000

BER
Before: Five units across both blocks 1 & 2 tested prior to retrofit. Four of these rated G and one rated F.
After: BERs ranging from B2 (120 kWh/m²/yr) to C1 (171 kWh/m²/yr)

Airtightness (at 50 Pascals)
After: three of twelve units were tested after retrofit, achieving results of 2.74, 2.86 & 2.92 m³/hr/m²

Walls
Before: concrete block walls with empty 100mm cavity. U-value: 1.0 W/m²K
After: Parex Lanko external insulation system to existing walls, comprising 100mm platinum EPS insulation and mineral render finish externally, along with 100mm blown bead insulation into existing cavity. U-value: 0.17

Roof
Before: sloped with mineral wool insulation: Roof slates to sloped areas externally. 150mm mineral wool insulation on the flat between roof joists and a combination of suspended ceiling tiles or plasterboard ceiling internally. U-value: 0.33
After: with added mineral wool insulation: Roof slates to sloped areas, 300mm mineral wool insulation on the flat between roof joists, and a combination of suspended ceiling tiles or plasterboard ceiling internally. U-value: 0.18

Windows & doors
Before: single-glazed, aluminium
New double-glazed windows: Viking alu-clad timber windows and doors. Overall U-value: 1.4

Heating system
Before: oil district heating for the full block, each apt with its own hot water cylinder.
After: Gas district heating fed by 89.7% efficient Worcester Bosch condensing gas boiler, instantaneous (plate heat exchanger to the units), no hot water storage.

Ventilation
Before: no ventilation system. Reliant on infiltration, chimney and opening of windows for air changes / holes in walls.
After: Aereco demand-controlled ventilation to each unit. Humidity sensitive wall-vents to prevent heat loss associated with over-ventilation.

(below and p75) before and after photos highlight the transformation of the social housing block. As there was no insulation at all before, one of the main changes was the addition of Parex Lanko EPS external insulation with mineral render finish. New double-glazed timber windows and doors also replaced the existing single-glazed units

THE CASE FOR MAKING PASSIVE HOUSE MANDATORY

There is a growing sense that passive house's time has come. Following on from the examples set by umpteen municipalities and local authorities in continental Europe, there are signs of public bodies in Ireland and the UK making the passive house standard mandatory. **Jeff Colley** describes the rapidly unfolding events and puts forward some key points to take note of as events unfold.

Dún Laoghaire-Rathdown County Council's decision to make the passive house standard mandatory for all new buildings in the county – albeit subject to public consultation – may prove to be the decisive breakthrough to make genuinely low energy building mainstream in Ireland – and may help to cajole the UK to keep up.

Much of the impressive recent growth in passive house in the UK has been driven by the public and non-profit sectors, with increasingly substantial passive projects such as social and affordable housing schemes, educational and civic buildings. In that context, Exeter County Council's recent decision to build its own housing to the passive house standard was welcome but not entirely surprising news. Meanwhile Kirklees Council are proposing to make passive house mandatory for development on the council's land, including when that land is sold.

Short of changing building regulations nationally, the initiatives taken by Exeter & Kirklees point the way to achievable passive house policy in the UK, for the foreseeable future. In a brazenly retrograde move, secretary of state for communities and local government Eric Pickles has prevented English local authorities from going further – with the other UK regions out of his reach thanks to devolution – by removing a clause in the Planning Act that permitted councils to set their own energy efficiency standards above those contained in building regulations. Essentially this means English councils can't impose a planning requirement that housing must be more energy efficient than the mediocre levels set out in Part L, though the renewable energy sector successfully lobbied for councils to retain the power to set renewable energy targets in planning.

The public consultation on Dún Laoghaire-Rathdown County Council's draft county development plan opens on 2 March, and the early signs indicate that the discussion will include some fallacies, unfounded assertions and hackneyed objections that mustn't distract us from the facts. The following list includes some key points to keep in mind as events unfold.

Passive house needn't cause construction cost increases

In Ireland this is already true, due to changes to Part L of the building regulations. It should also be the case in the UK from next year, when the mooted zero carbon homes deadline kicks in.

According to the Department of the Environment, the average new Irish home that meets minimum compliance with Part L is expected to hit a calculated primary energy demand of 60 kWh/m²/yr[1] – a mid A3 BER. That's an average across all house types. More compact dwelling types such as apartments tend to be in or around or below 50 kWh/m²/yr, which means an A2 BER. In urban and suburban local authorities, the development is likely to include an emphasis on more compact forms such as apartments and terraces so for many developers, an A2 is already a minimum requirement.

In fact designing to the passive house standard may reduce construction costs in many cases. Building regulations are completely disinterested in the form of a building. If I ask an architect to design a 200 sq m home for me, and I want a H-shaped bungalow upon which to land my helicopter, Part L's only concern is that I reduce the energy demand of that building by 60% compared to a poorly insulated H-shaped bungalow. If I had instead asked for a two-storey rectangular building, my 200 sq m would have a much tighter footprint, meaning considerably less surface area for roof, floor and walls per sq m of floor area, and substantially reduced spend on materials. It would also mean reduced heat loss, for the same reason.

There are other potentially significant construction cost savings too – such as those achieved by reducing the size of heating systems, given the tiny space heating loads of passive houses, and by avoiding the need for repair or replacement due to surface or interstitial condensation caused by less robust energy efficiency approaches. Economies of scale and increased competition are already bringing prices down, with a number of major construction brands coming into the passive house space, as many of the adverts in this and previous issues of Passive House Plus have demonstrated.

It's possible to build an expensive passive house too, of course. Some – but far from all – of the clients who build passive houses are willing and able to pay for the highest quality materials, and for other sustainability features (which may or may not add cost). So a high spec passive house must be compared to the cost of a high spec A2/A3 house. Conversely, we have previously published examples of passive houses being built for in or around €100 per sq ft – prior to the benefits that economies

of scale and increased competition will have as passive house becomes more common.

Higher construction costs won't necessarily cause house price rises

As any property economist worth their salt would agree, the market determines what property prices are acceptable. If a developer bids for land, and expects construction costs to be higher to satisfy a mandatory passive house target – even though that expectation is likely to be incorrect in Ireland given the A2/A3 BER requirement – they'll accordingly bid less for the land, causing land valuations to fall. It's therefore a question of total development costs remaining the same, but the ratio shifting more towards construction costs (meaning the creation of more jobs with high export potential, due to the innovative and international nature of passive house) and away from land costs, which means less money wasted on something as economically unproductive as land changing hands.

If buyers are willing to pay more for passive houses – as might seem reasonable, once public awareness of the benefits of passive house are more widespread – it'll just mean buyers being less likely to buy less efficient stock, unless the price is right. But existing homeowners needn't worry – there's much more existing stock on the market than new homes at any given time, meaning the effect would be spread across a greater pool of housing.

It's a moot point to argue that land prices in poorer areas may be too low to fall to absorb the extra construction costs of meeting passive house, as the same issue would apply to Part L. The logic of such thinking leads to dangerous places. If poorer areas are in need of regeneration, the solution is not to build substandard housing in those areas, consigning the occupants to needlessly high energy costs, fuel poverty risk and associated health risks, and stigmatisation as second class citizens.

Less robust current approaches will lead to building failures

Though Irish developers already have to build new homes to an A2 or A3 BER, neither the building regulations nor the Deap software (for generating BERs and demonstrating Part L conformity) give sufficient guidance to ensure that these buildings will perform properly. (Sadly, the government appears to be utterly incurious about the extent of this problem. Ten years after it was completed, the only study that the Irish state has ever commissioned to check how a representative sample of new homes complied with any parts of building regulations – the Energy Performance Survey of Irish Housing – remains unpublished. Yet its conclusions were utterly damning: only 1 of 52 homes complied with the 1997 version of Part L of the building regulations, and 19 out of 20 of a subset of those homes subject to combined thermography and pressure tests showed either missing insulation or cold bridging in contravention of the regs.

The same problems occur with the UK regulations. There are very real risks that new homes will therefore:

- threaten occupant health, due to poor indoor air quality;
- require repair/replacement work due to surface/interstitial condensation;
- consume far more energy than the BER indicates, and contribute needlessly to climate change;
- depreciate in value as a consequence of all of the above.

Most specifically, a peer-reviewed study printed recently in the Environment International journal demonstrates that in even moderately energy efficient homes in the UK, there's a statistically significant increase in doctor diagnosed asthma rates. The report puts this down to inadequate ventilation and heating. (This study is covered in greater detail in an opinion piece by the study's co-author Richard Sharpe in this issue).

Building regulations permit ventilation approaches that aren't proven to work in low energy buildings – such as the industry default of "hit and miss" manually closable holes in walls in living rooms, with mechanical extract in wet rooms – as Kate de Selincourt covered in exhaustive detail in issue 6 of Passive House Plus. These crude ventilation approaches are causing countless problems in recently built buildings – a fact that many local authorities are all too familiar with.

> "The growth of passive house is already opening significant opportunities for construction product manufacturers, designers and tradespeople to sell goods and services into other markets."

Note that Dún Laoghaire-Rathdown's proposal does leave the door open for the consideration of appropriate alternatives to passive house. Here the burden of proof should be on the industry to submit evidence that stands up to scrutiny, to demonstrate that these alternatives deliver equivalent performance with regard to energy use, indoor air quality, and general build quality. In the case of ventilation as one constituent part of a hypothetical alternative approach, compelling evidence exists for some mechanical ventilation strategies, such as DCMEV, with monitoring studies supporting both indoor air quality and heat loss reduction claims.

In this case, the moderately good is the enemy of the excellent

Constructing new buildings to moderately good energy performance levels risks preventing them from ever achieving excellence. It's much harder to justify retrofitting that building than it is a very poor performing building. The paybacks won't be as compelling, the discomfort won't be as great. Perversely, one of the factors that may drive people to upgrade these buildings at considerable avoidable expense is the presence of surface and interstitial condensation arising from poorly conceived energy efficiency approaches.

The Construction Industry Federation has a long history of objecting to energy efficiency regulations

This extract, from a fully referenced article our deputy editor Lenny Antonelli wrote in issue nine volume five of our predecessor magazine Construct Ireland, bears repeating:

As far back as 1978, Construction Industry Federation managing director Thomas Reynolds argued against making insulation mandatory in new houses because "all builders are putting fibreglass into attics now anyway by choice". He said that making it compulsory was an "entirely unrealistic and bureaucratic approach" that would "automatically hike up the price of houses". He also argued that the double-block cavity wall system was too expensive to be practical.[2]

The CIF has made similar pronouncements over the years, warning Irish Independent readers in 2007 that the industry didn't have the "technical capacity" to meet government plans to mandate 40% energy reductions and renewable energy systems.

Earlier that year, the Irish Home Builders Association (IHBA) – a part of the CIF – objected to Dún Laoghaire-Rathdown County Council's plan to introduce 60% energy reductions for new buildings on the basis that the target was "not achievable". A 40% better standard was ultimately introduced.

So in that context it's unsurprising that IHBA & CIF director Hubert Fitzpatrick has objected to Dún Laoghaire-Rathdown's passive house policy, stating that the policy "will increase the cost of new build even further", and that if the policy goes ahead "there will be very few houses built in Dún Laoghaire-Rathdown next year". When the CIF objects to progressive policies like this – against the better wishes of many of its members, including some with real expertise in delivering highly energy efficient buildings – we should remember their track record in these matters.

Passive house has international cachet, meaning export opportunities

Compared to passive house, Ireland and the UK's national methodologies for energy rating look decidedly parochial. This isn't to denigrate them – it's simply that they were created solely. Terms like BERs, EPCs, Part L, Sap and Deap mean nothing to a client in, say, Germany, America or Japan. Passive house on the other hand is demonstrably the world's leading low energy building standard, is growing exponentially and bound to become mainstream across much of the world as countries act to address climate change and energy security with low energy building approaches that actually work. This growth is already opening significant opportunities for construction product manufacturers, designers and tradespeople to sell goods and services into other markets. These opportunities are bound to continue to grow as more regions – and ultimately nations – turn to passive house as that elusive thing: a proven way of building genuinely low energy, robust, healthy buildings.

[1] Note that this primary energy figure includes heating, hot water, ventilation and lighting, but not plug in electrical loads, which in low energy buildings tend to represent roughly half the total. The primary energy figures in the PHPP software instead include all energy usage. For this reason and several others, such as the fact that PHPP assumes consistent comfortable temperatures whereas the Irish and British national software tools assume the set temperatures are achieved for as little as eight hours a day, it's impossible to compare the tools.

[2] Question of minimum levels of insulation generates some heat, Irish Times, p20, 18 August 1978